

BEST AVAILABLE

The diagram illustrates a multi-channel optical communication system 10. At the top, a dashed box 20 represents a light source assembly containing four HDT (High Density Transmitter) units 32 and one VHDT (Variable High Density Transmitter) unit 34. These are connected to a SPLITTER 38. The output of the splitter is distributed to four ODM (Optical Demultiplexer) units 18. Each ODM unit is connected to a corresponding HDT unit via a bidirectional line 24/26. The ODM units are also connected to a common output line 30, which is shown as a series of four parallel optical paths 44. Each path 44 contains a series of optical components, including a lens 41, a filter 45, and a detector 47. The output line 30 is connected to a common output line 44, which is shown as a series of four parallel optical paths 44. Each path 44 contains a series of optical components, including a lens 41, a filter 45, and a detector 47. The output line 30 is connected to a common output line 44, which is shown as a series of four parallel optical paths 44. Each path 44 contains a series of optical components, including a lens 41, a filter 45, and a detector 47.

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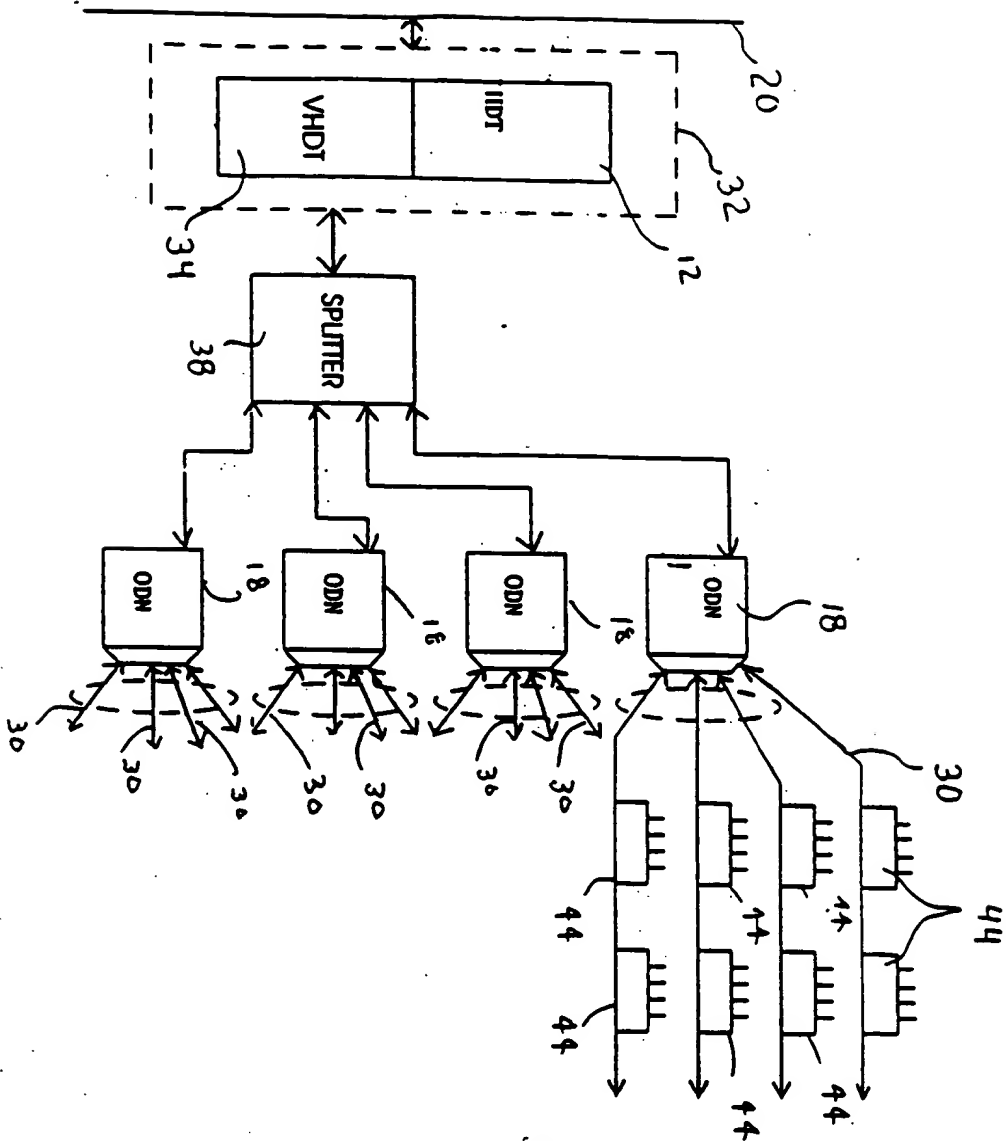


Figure 2

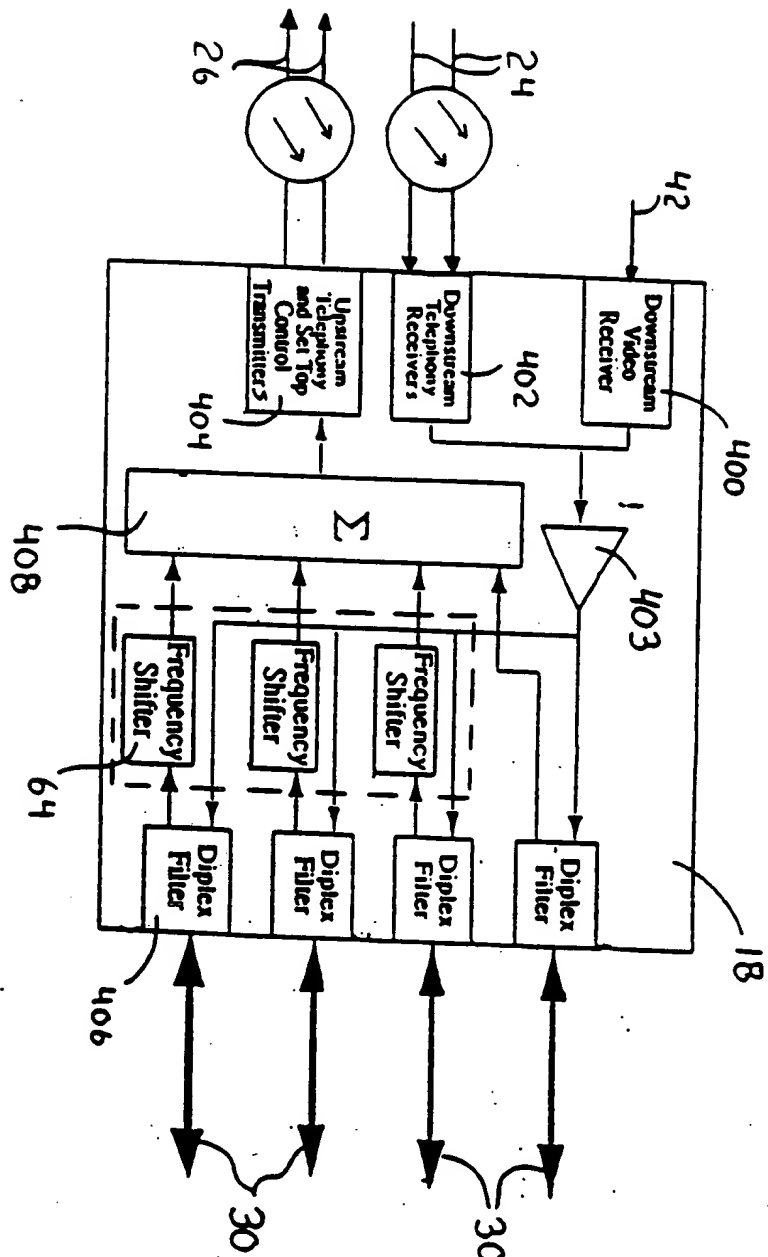


Figure 5

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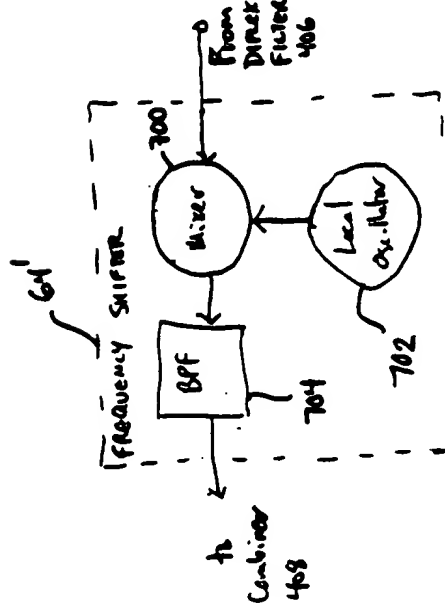


Fig. 7

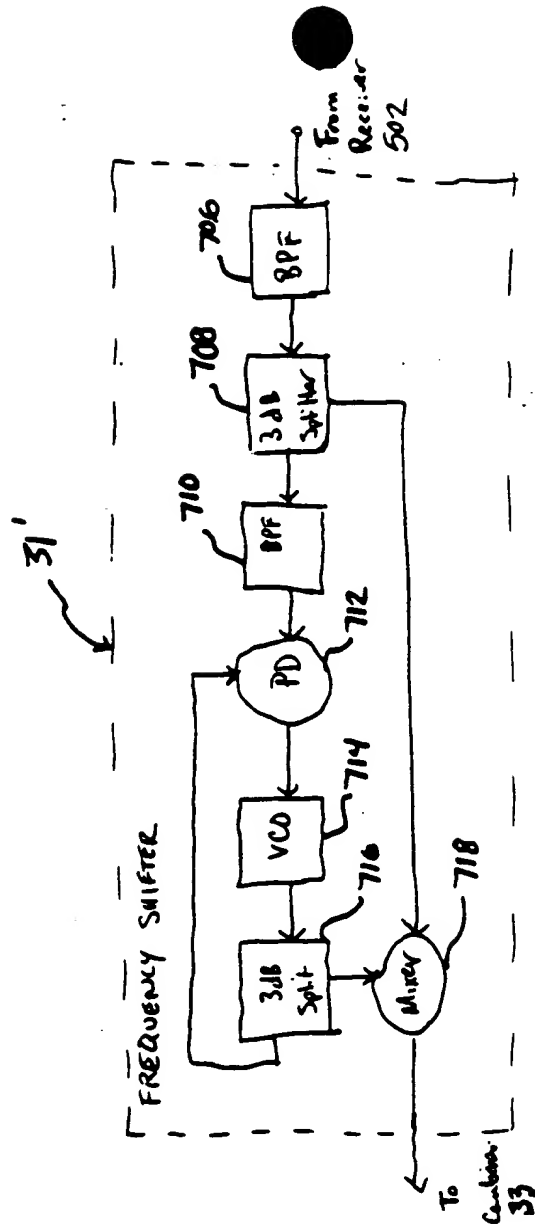


Fig. 6

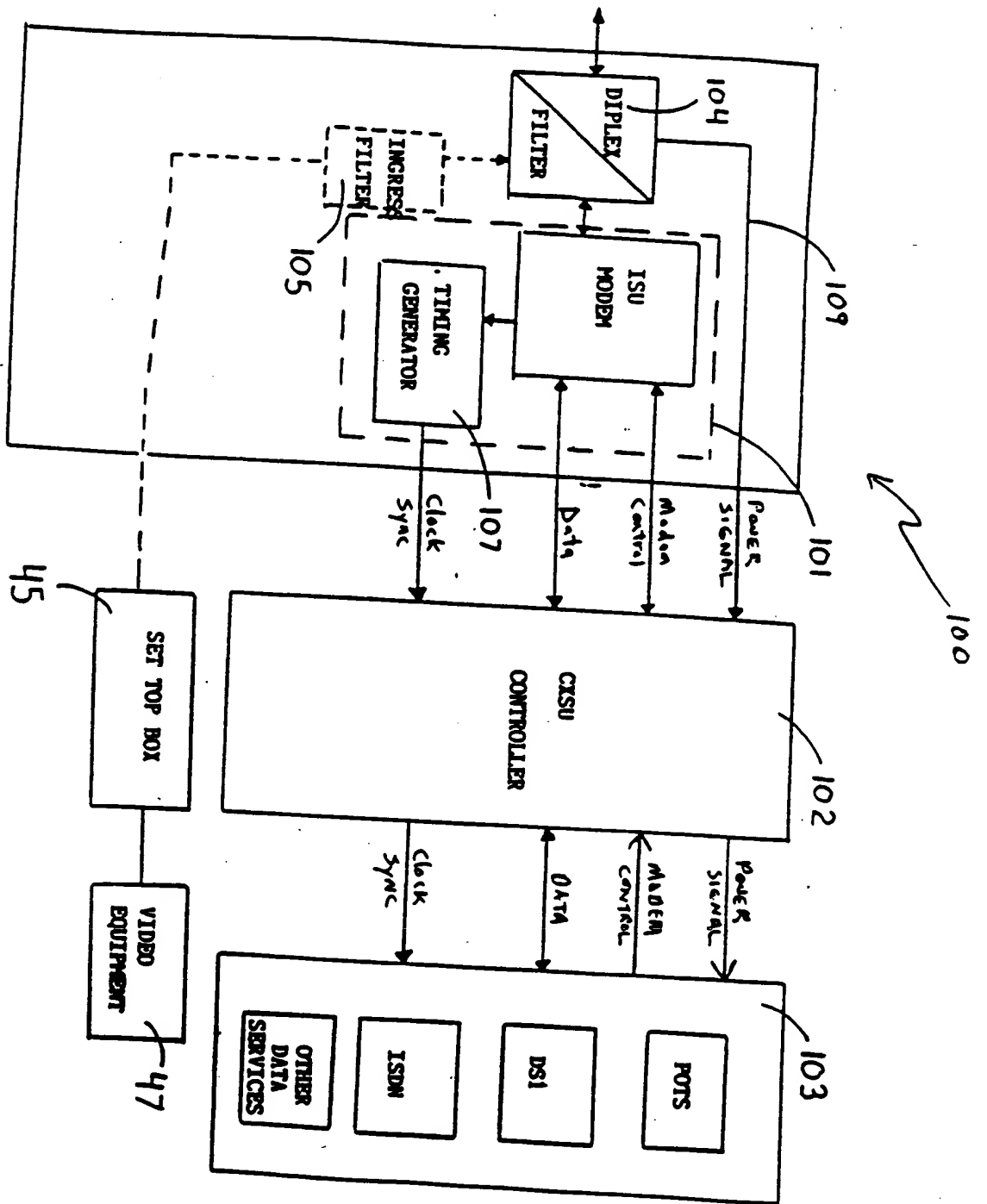


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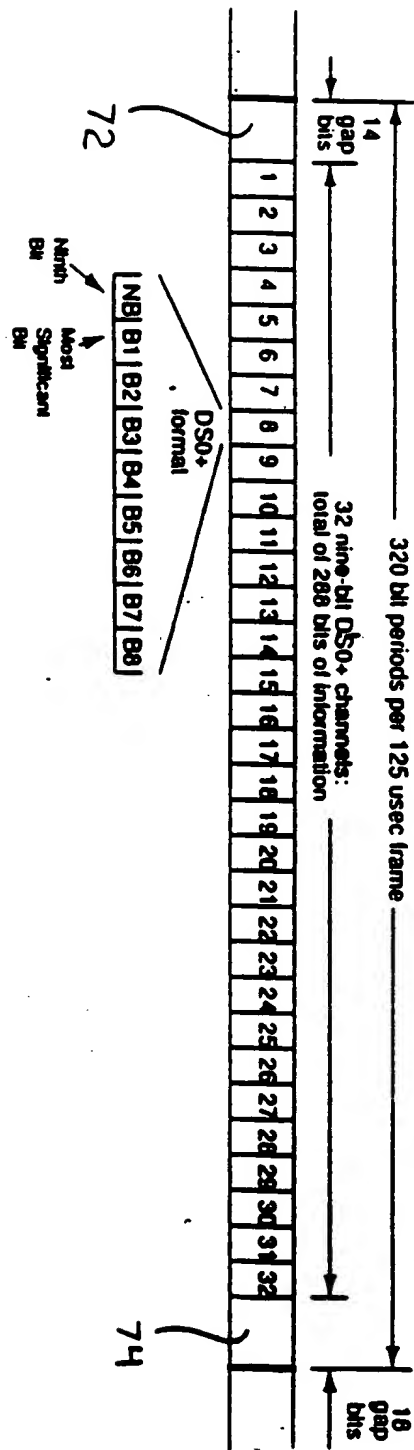


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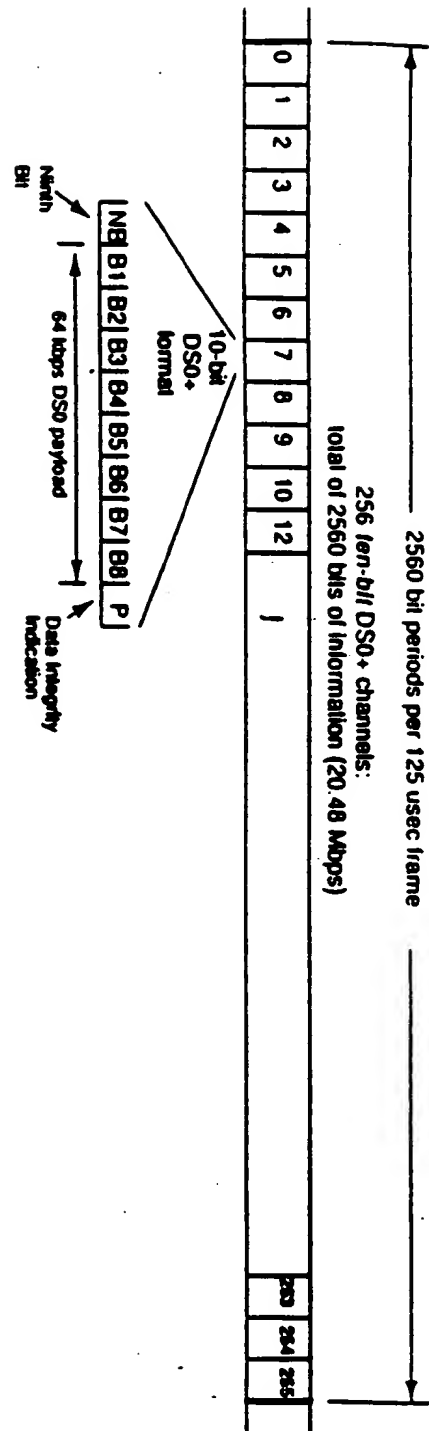


Figure 10

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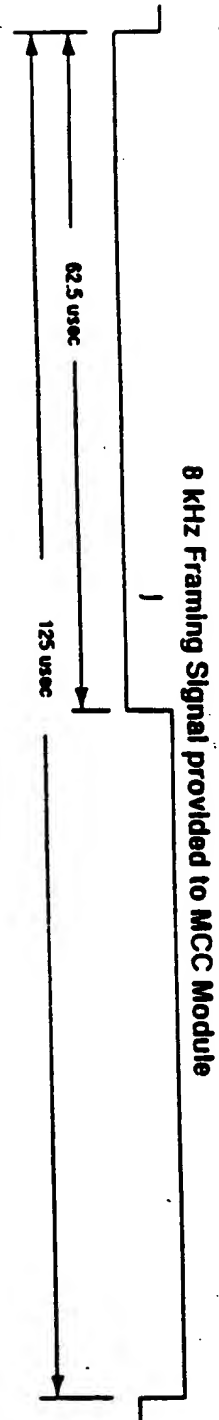


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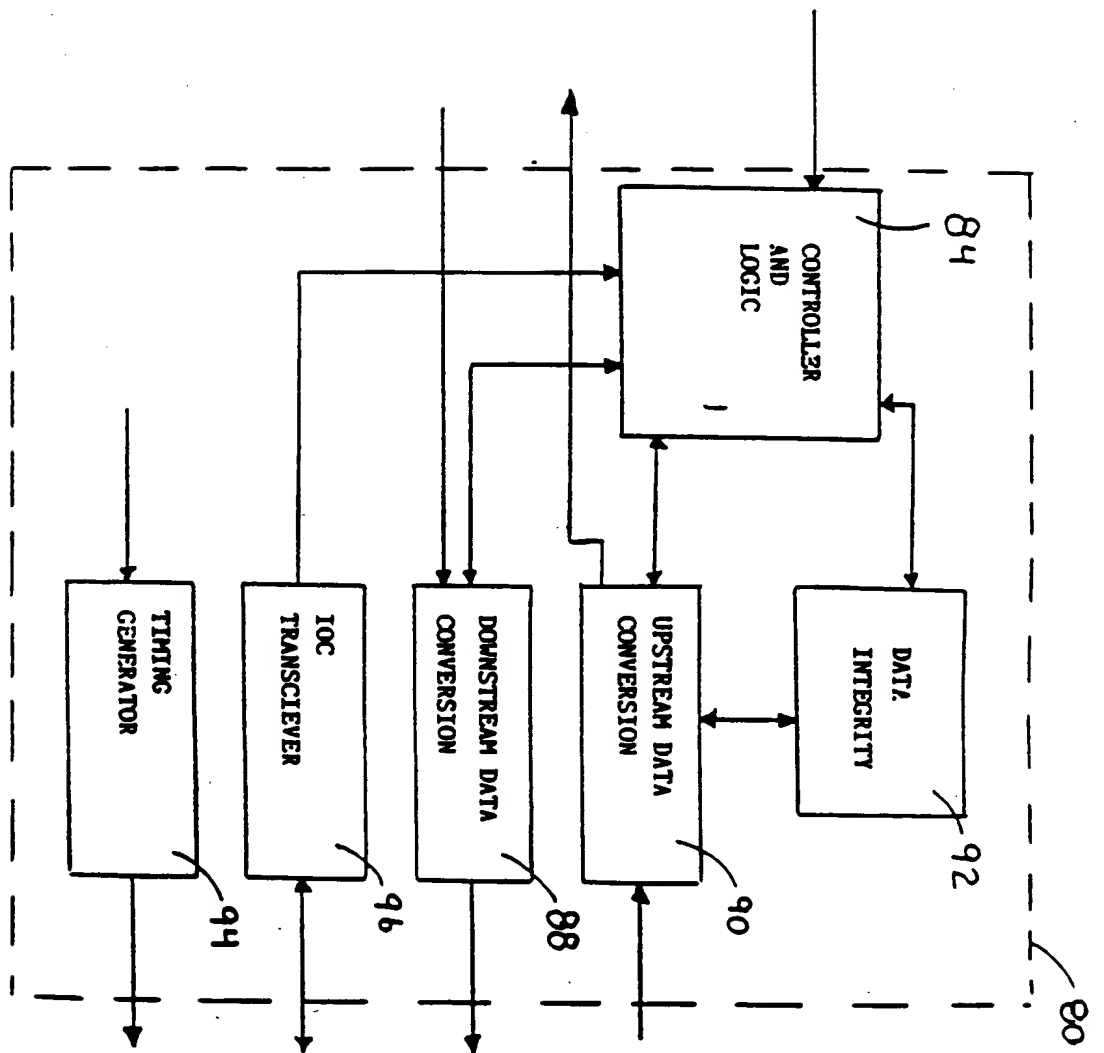


Figure 12

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Fig. 13

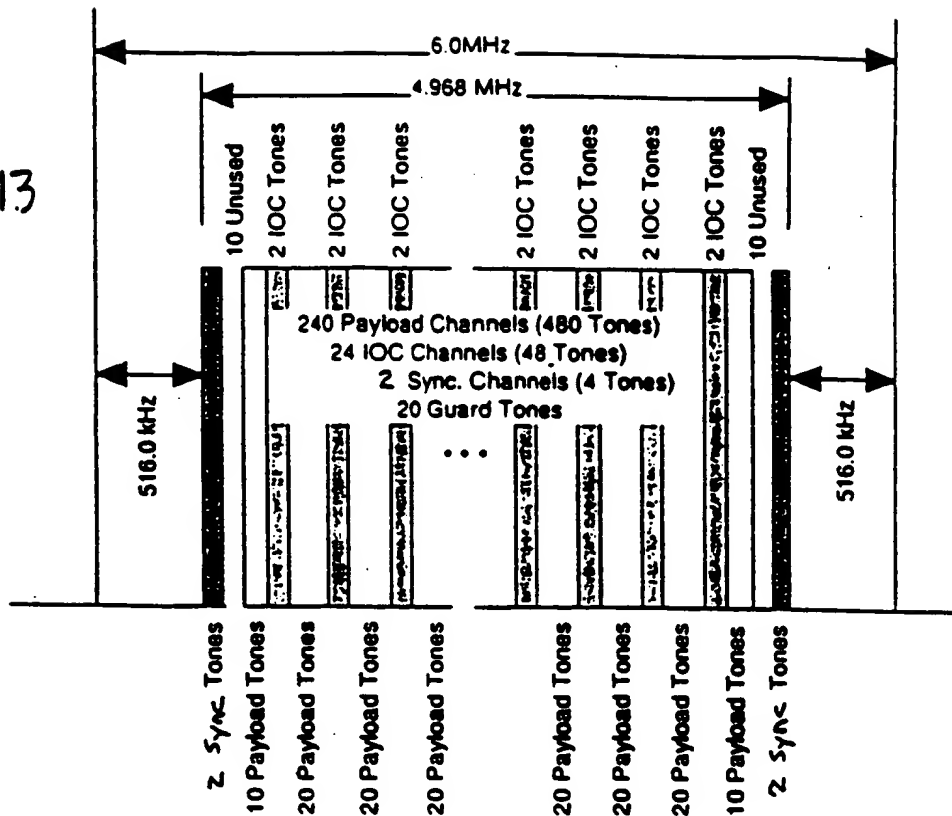
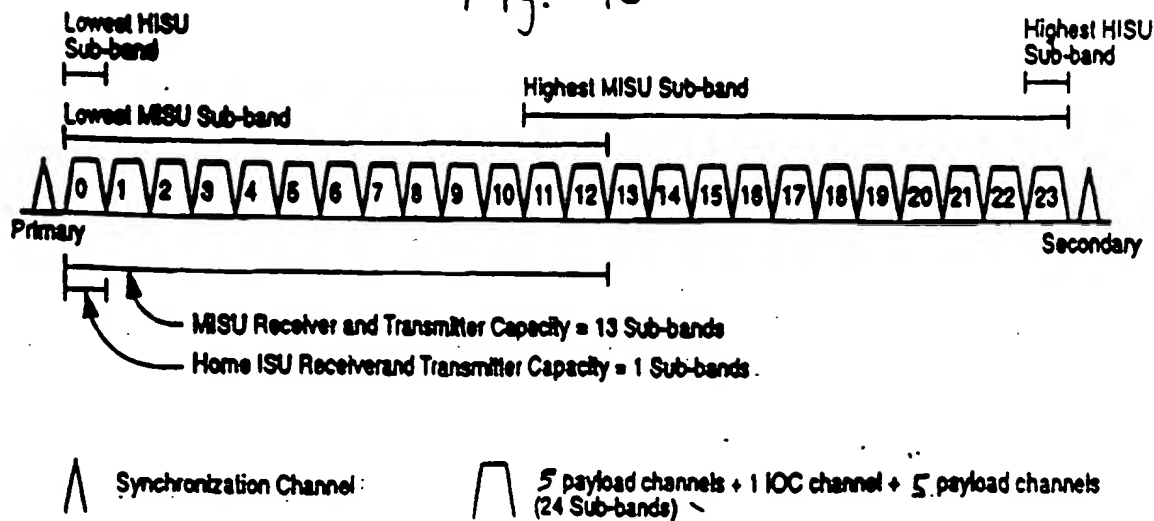


Fig. 16



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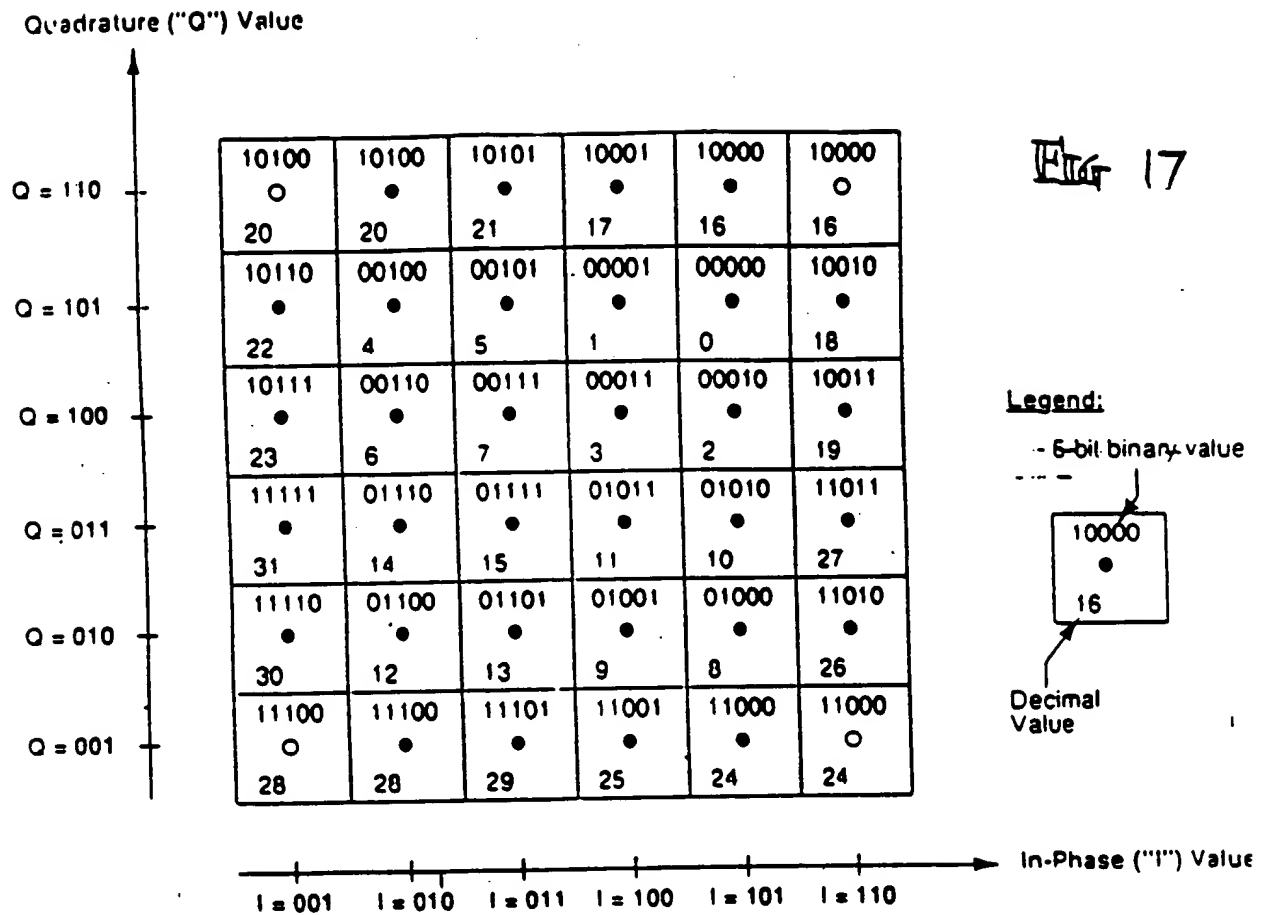


Fig 17

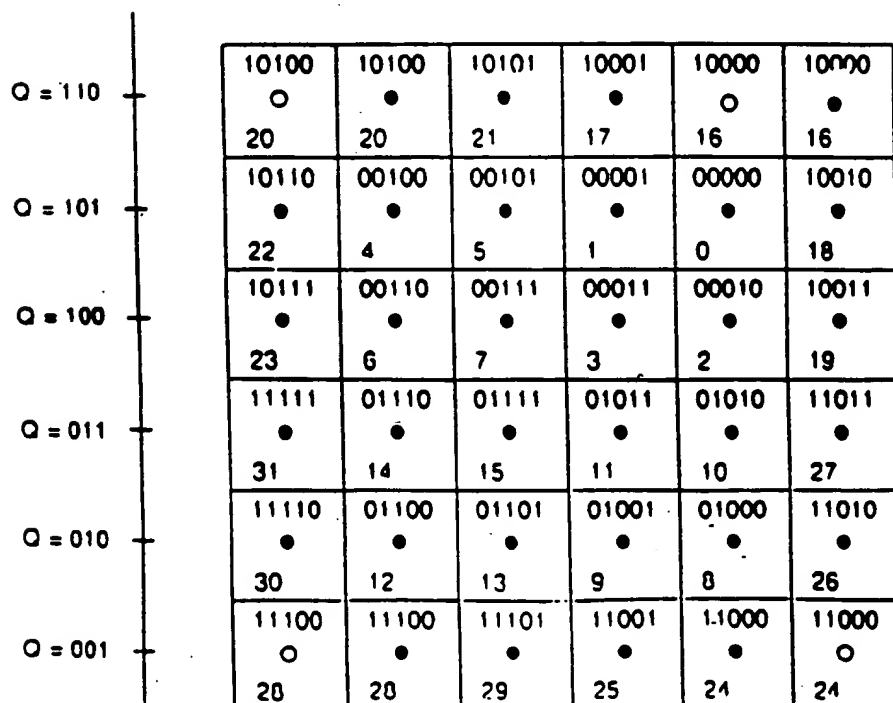


Fig 18

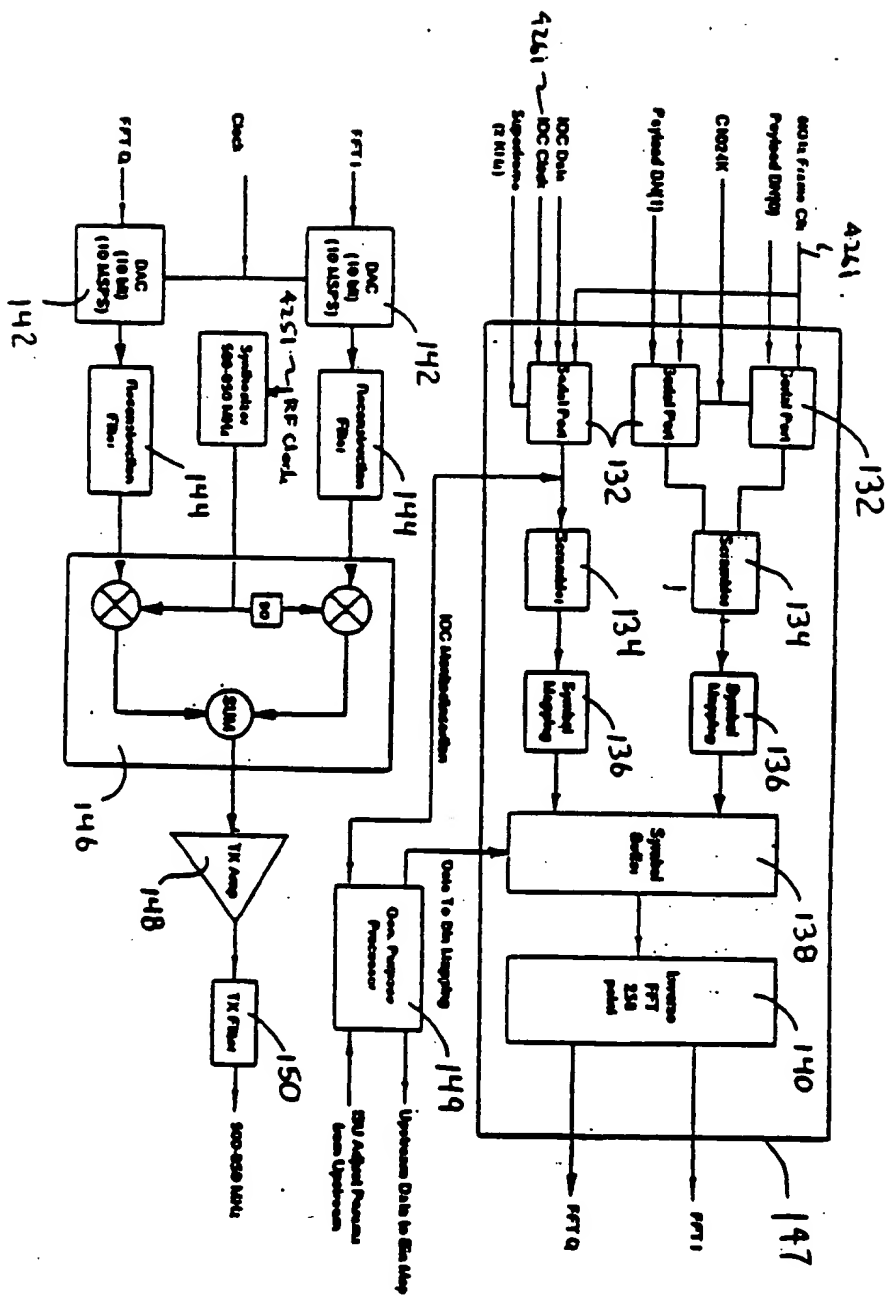


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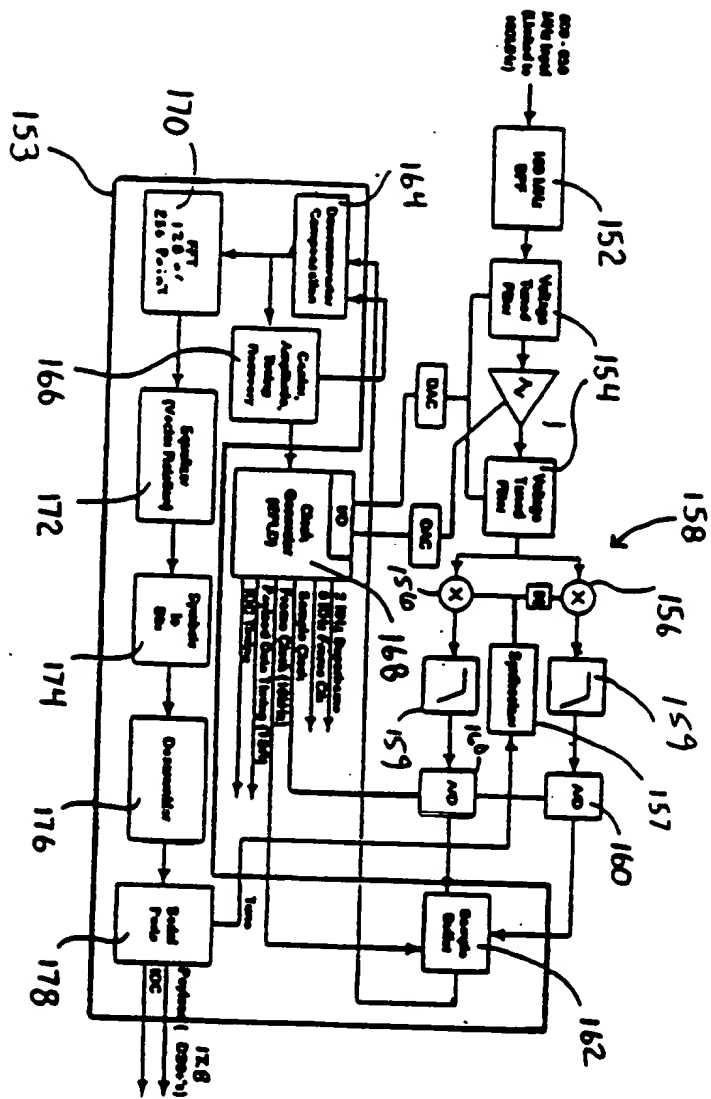
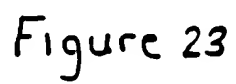


Figure 22



$\frac{1}{\sqrt{\pi}} \int_{-\infty}^{\infty} f(x) e^{-x^2} dx = \frac{1}{\sqrt{\pi}} \int_{-\infty}^{\infty} f(x) e^{-x^2} dx$

663760-42660

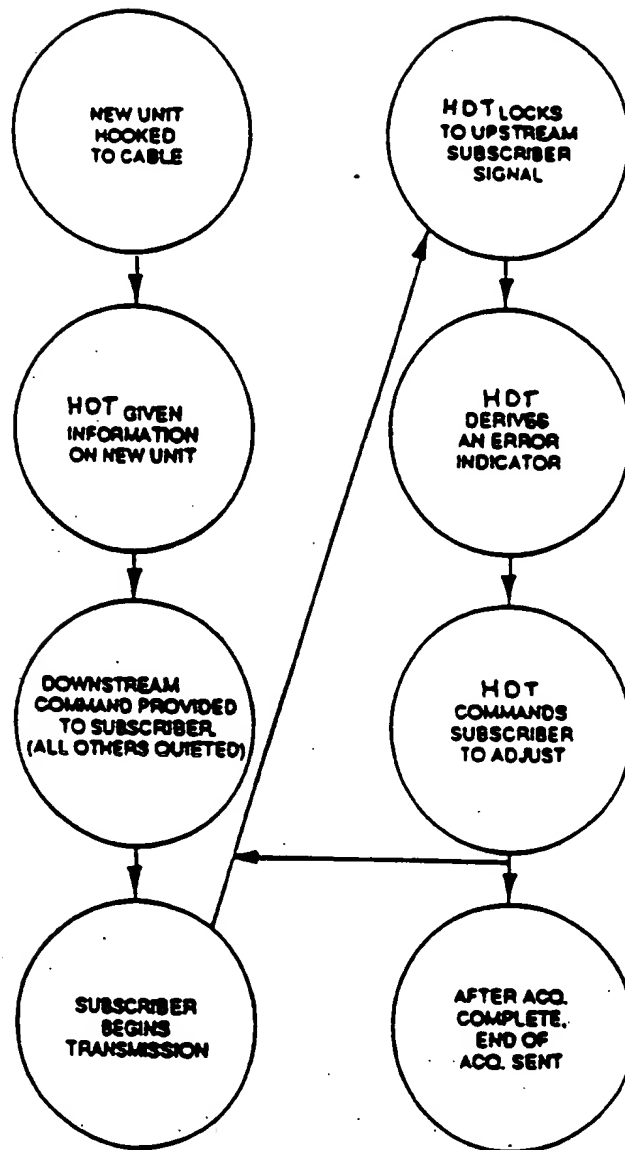


Figure 27

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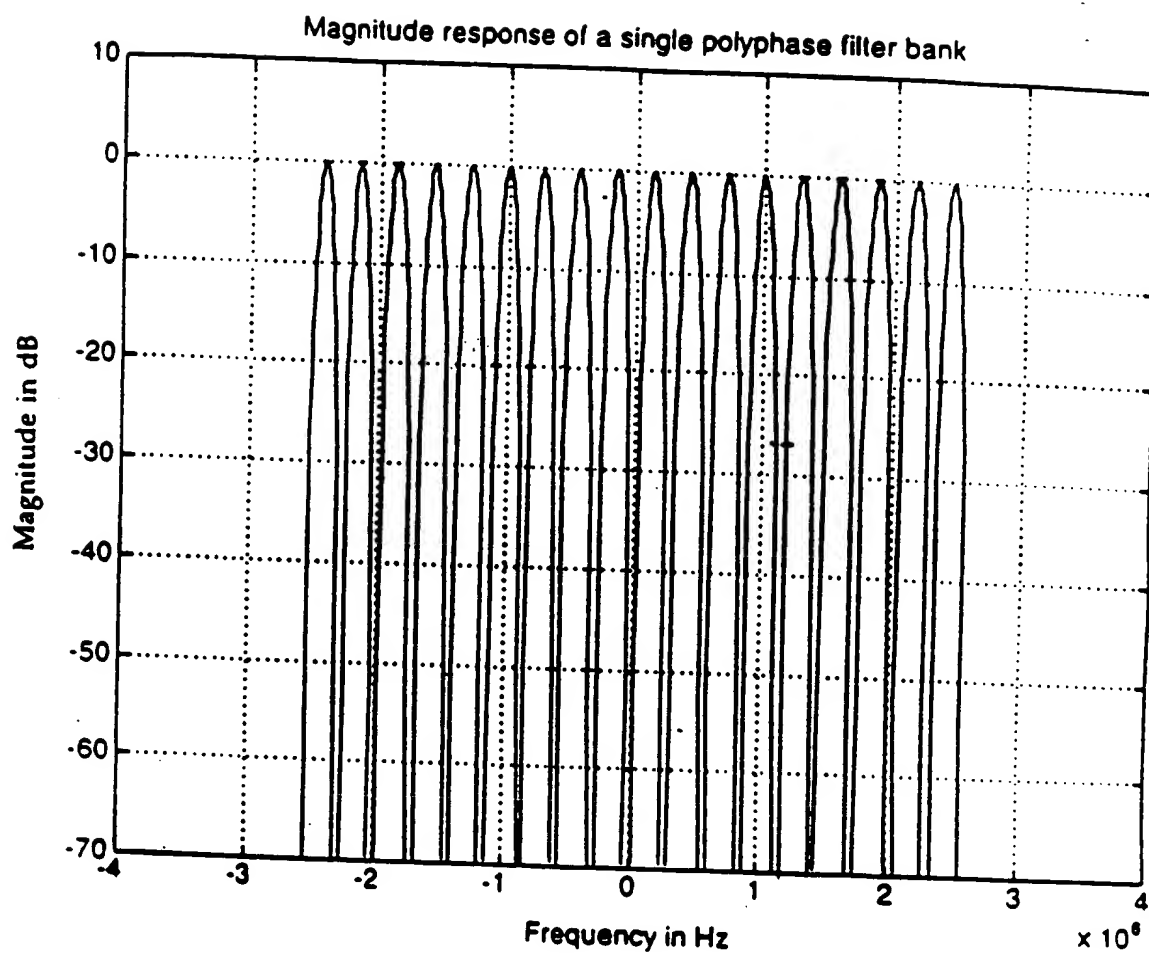


Figure 29

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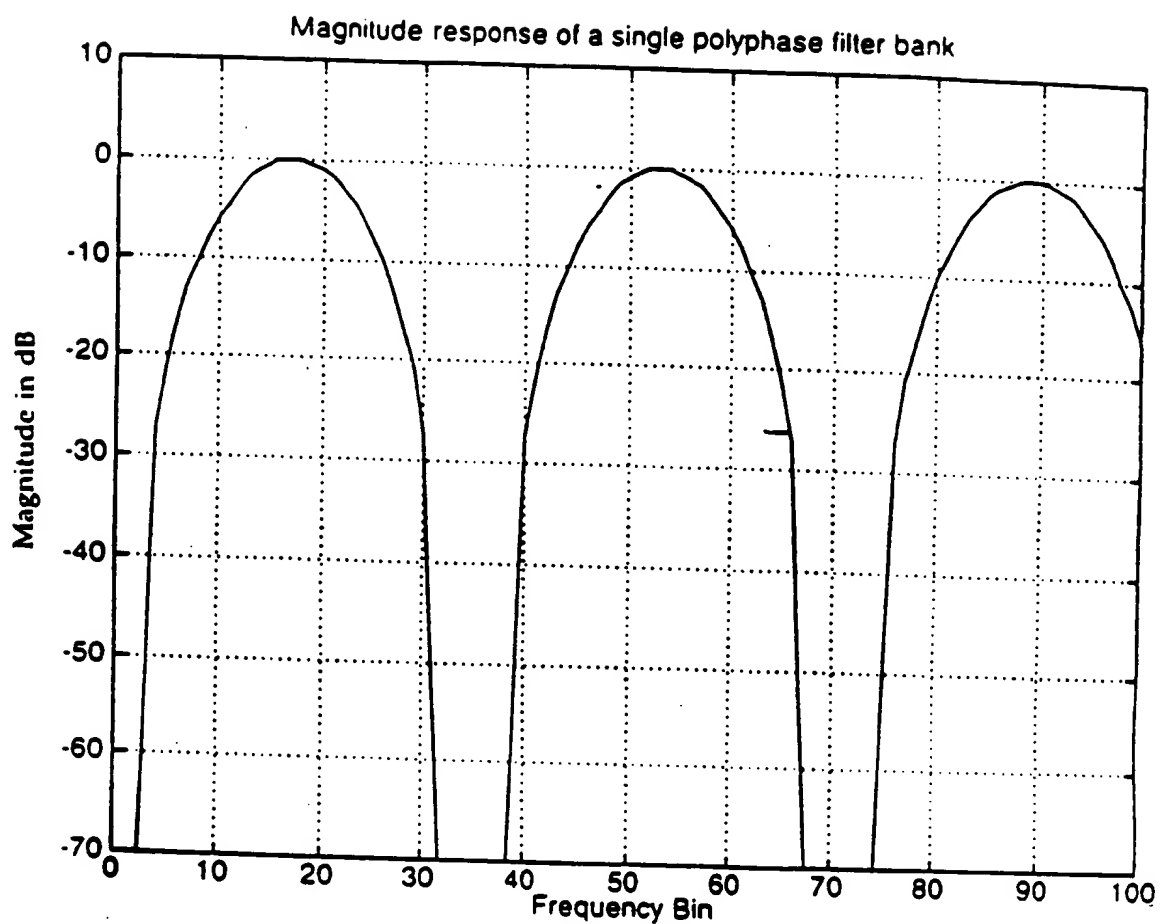


Figure 30

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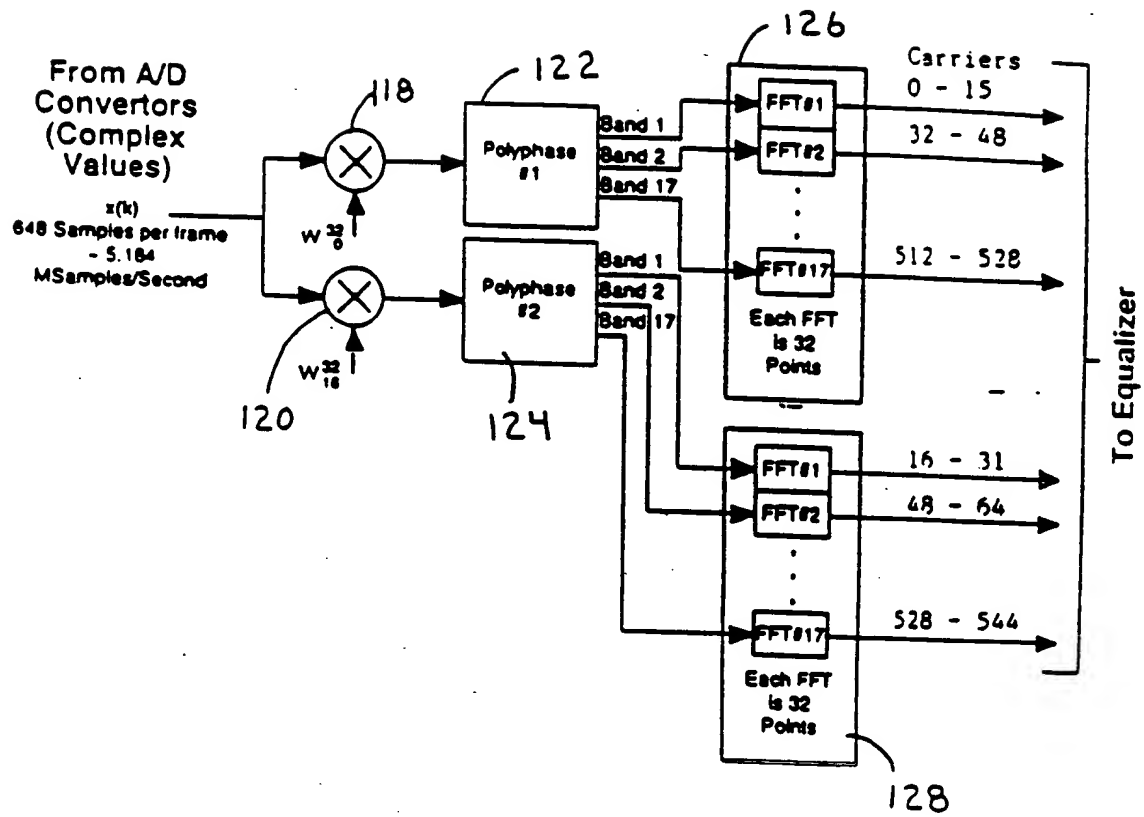


Figure 31

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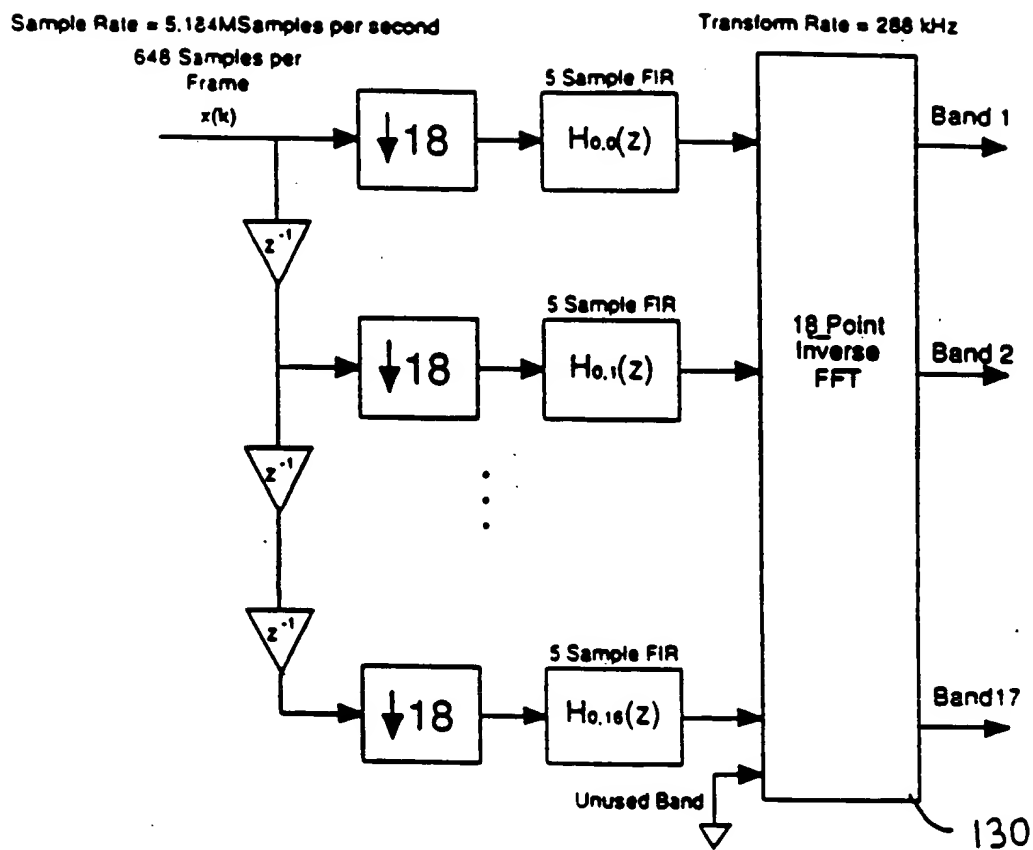
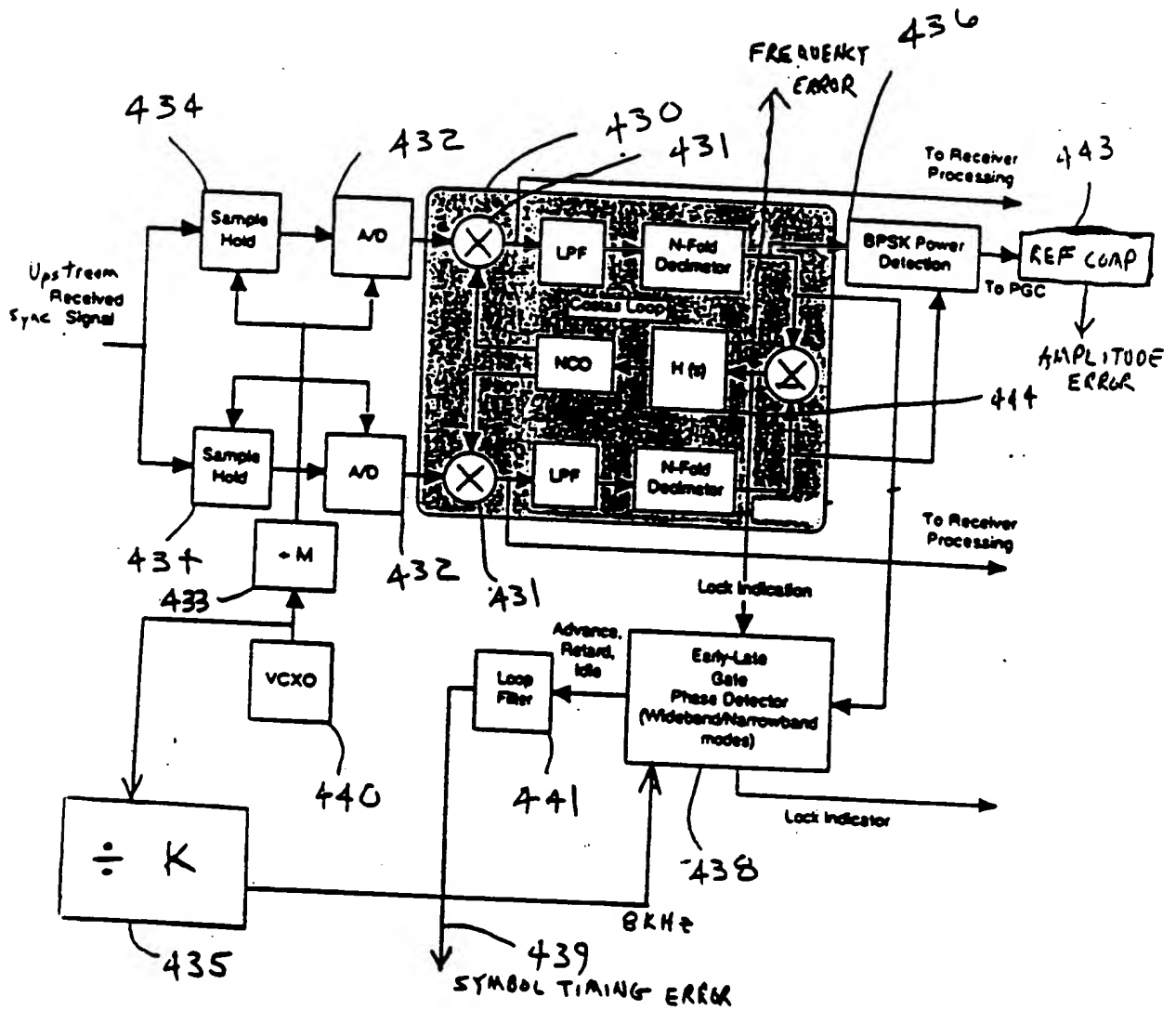


Figure 32.

The diagram illustrates a Costas Loop receiver system. A **Downstream Received Sync Signal** is input to two **Sample Hold** blocks (334) and two **AO** (Analog Output) blocks (332). The outputs of the AO blocks are fed into two multipliers (331) within a shaded **Costas Loop** block (330). The Costas Loop also contains **LPF** (Low Pass Filter) blocks, **N-Fold Decimators**, and an **M(s)** block. The outputs of the multipliers are fed back into the Costas Loop. The Costas Loop outputs are connected to **To Receiver Processing** and **To PGD** (To Power Gain Detector). The Costas Loop also outputs a **Lock Indication** signal to the **Early-Late Gate Phase Detector (Wideband/Narrowband modes)** (338). The Early-Late Gate Phase Detector outputs a **Lock Indicator** signal. The Early-Late Gate Phase Detector also outputs a signal to a **÷ K** block (335), which outputs a signal to a **VCXO** (Variable Frequency Crystal Oscillator) block (340). The VCXO outputs a signal to an **+M** block (333), which outputs a signal to the two **Sample Hold** blocks (334). The VCXO also outputs a signal to the **Loop Filter** (331), which outputs a signal to the **VCXO** (340). The **Loop Filter** also outputs a signal to the **Early-Late Gate Phase Detector** (338). The **Early-Late Gate Phase Detector** also outputs a signal to the **Lock Indicator** (338).

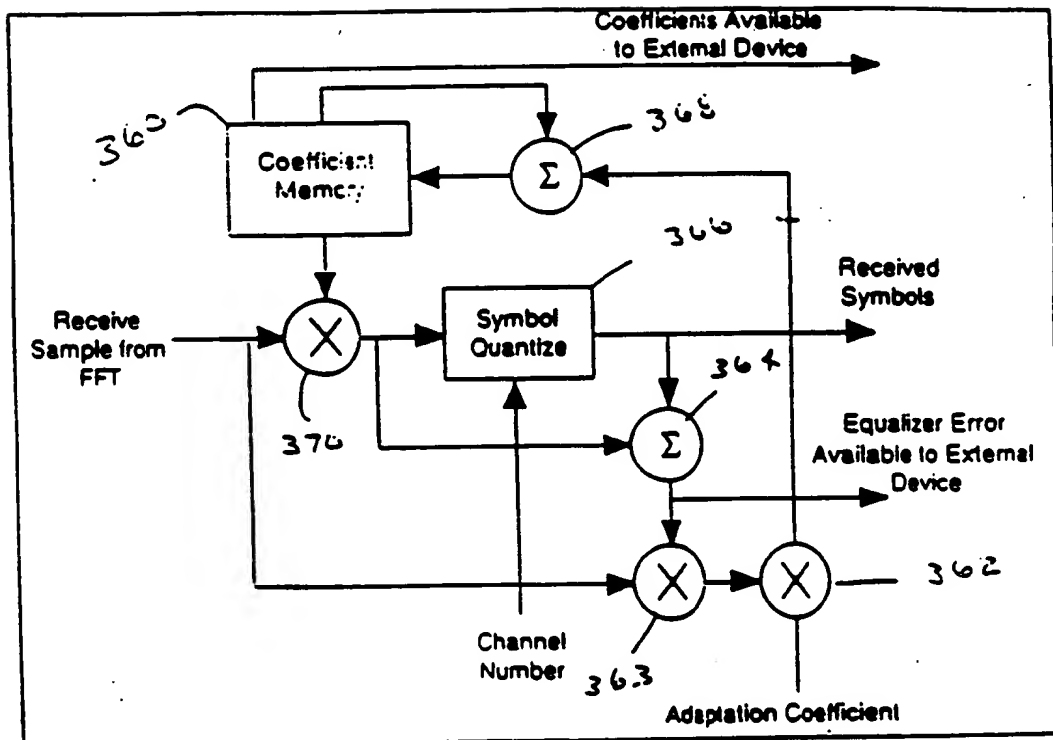
Figure 33

665760" 4226260



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Figure 34

005460 1422000



172, 214
Figure 35

66370-12600

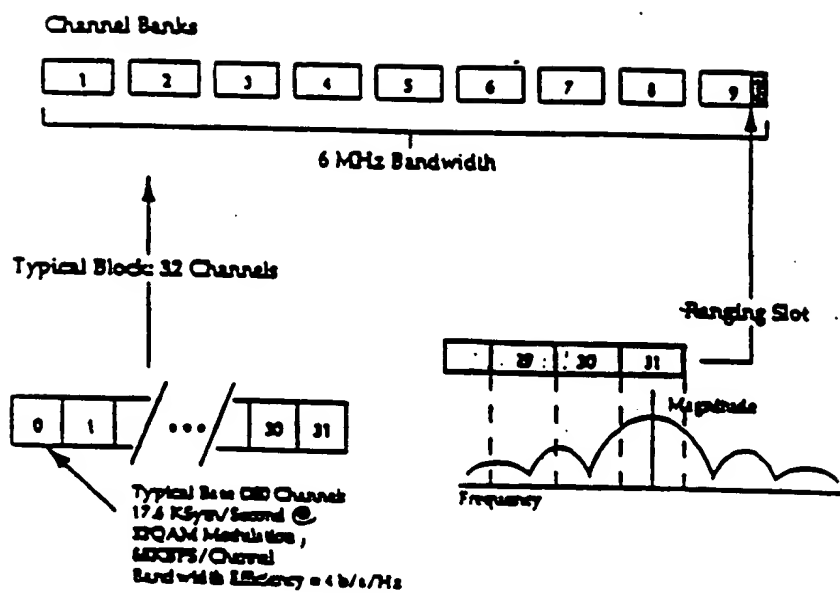


Figure 36

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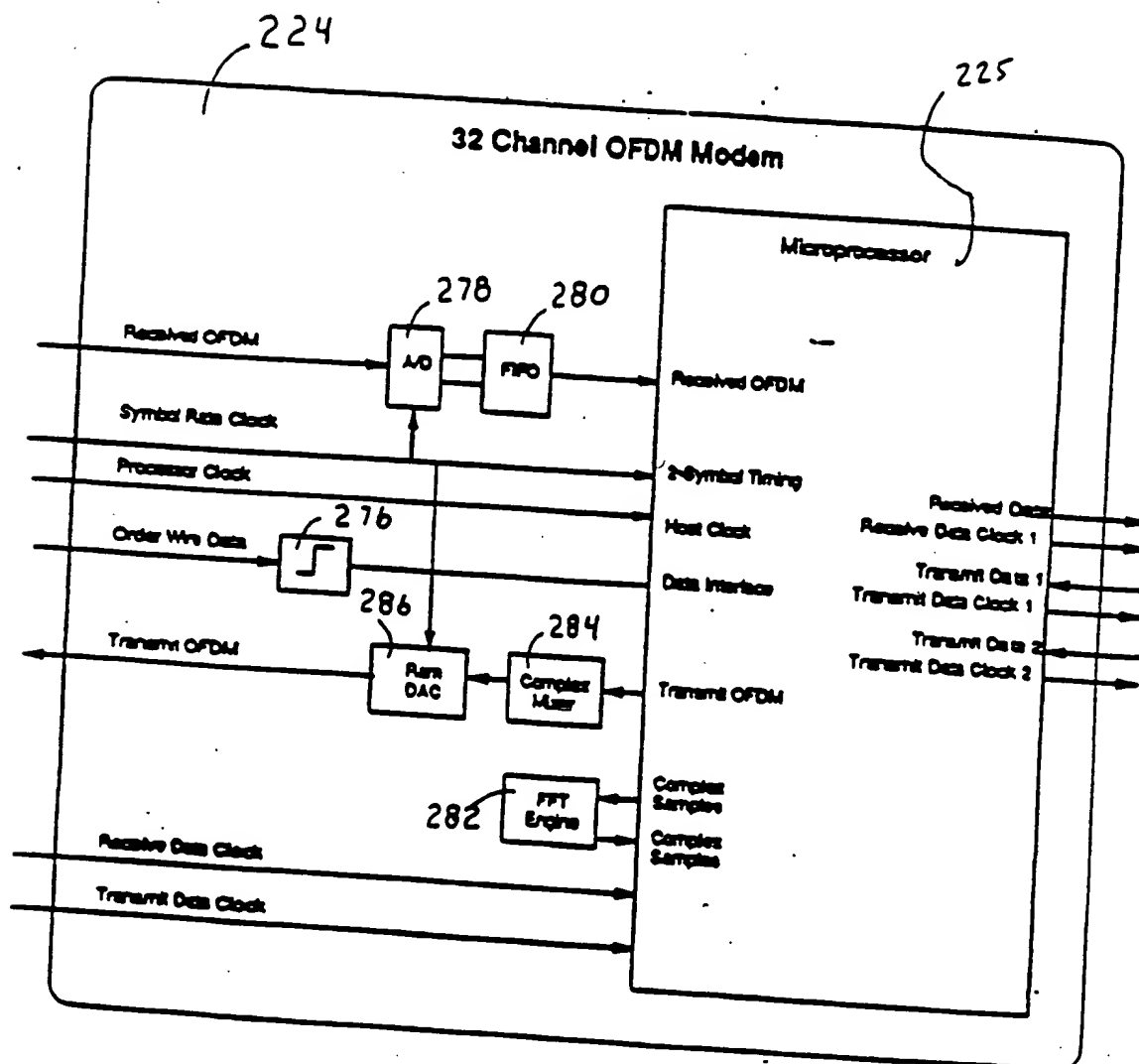


Figure 39

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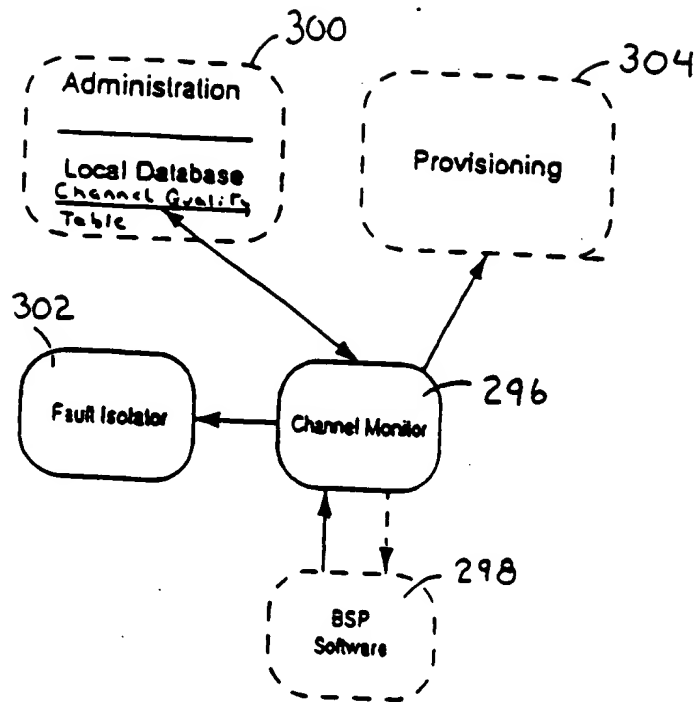


Figure 40

Figure 41

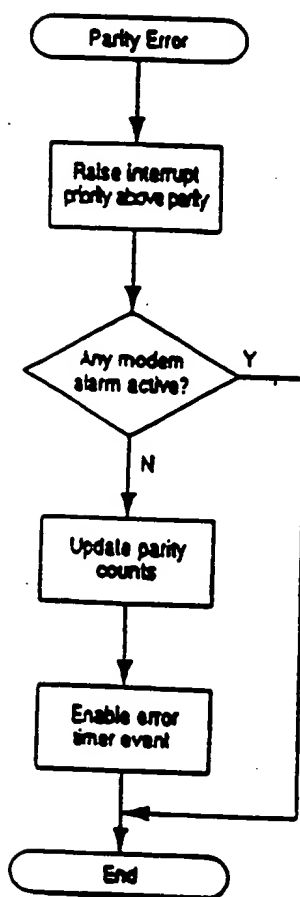


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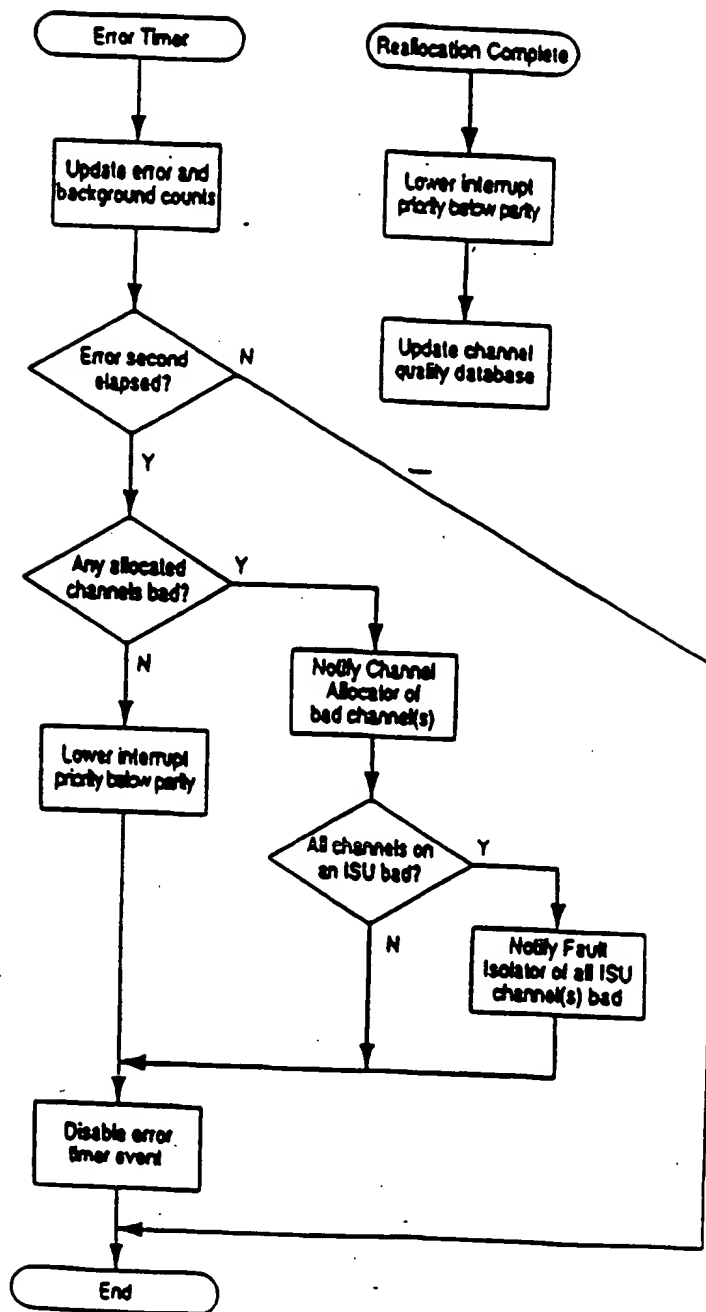
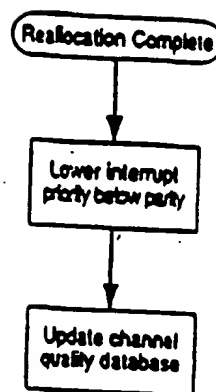


Figure 43



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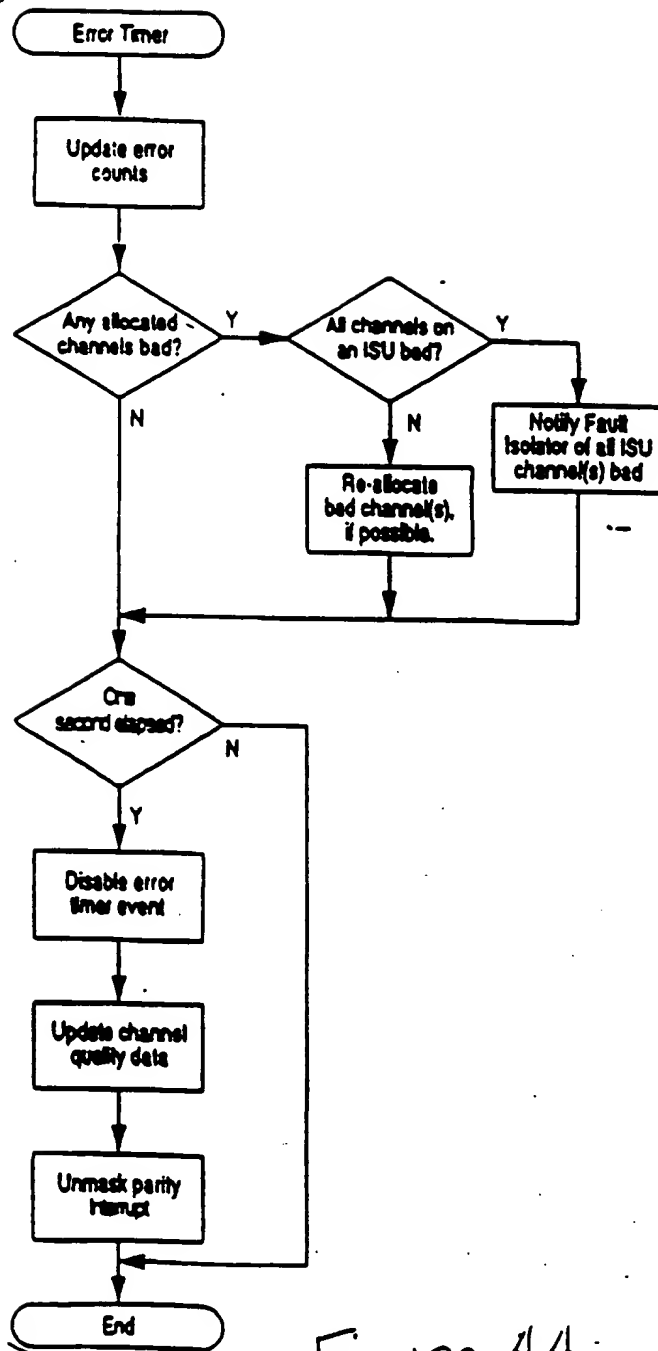
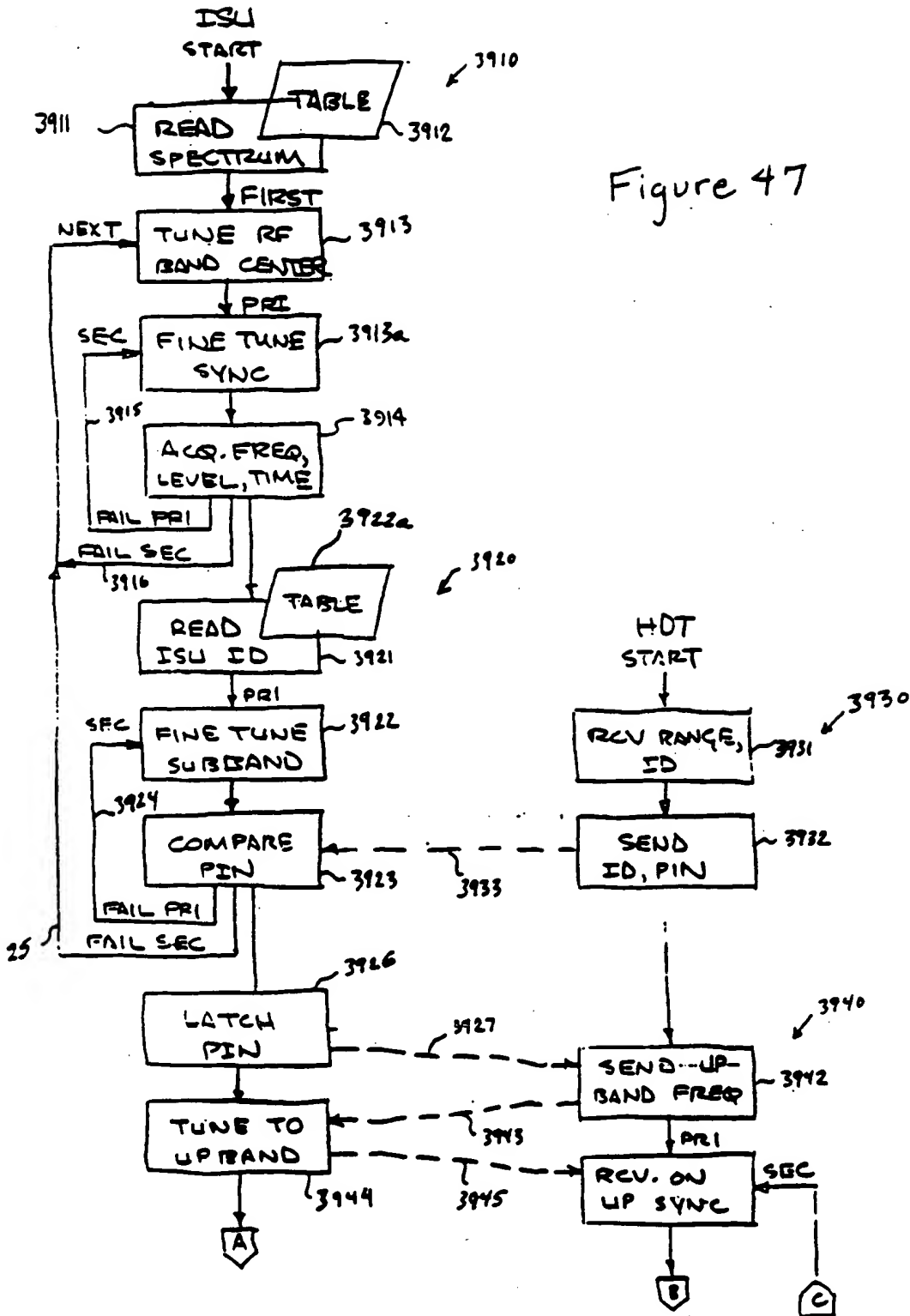


Figure 44

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Figure 47



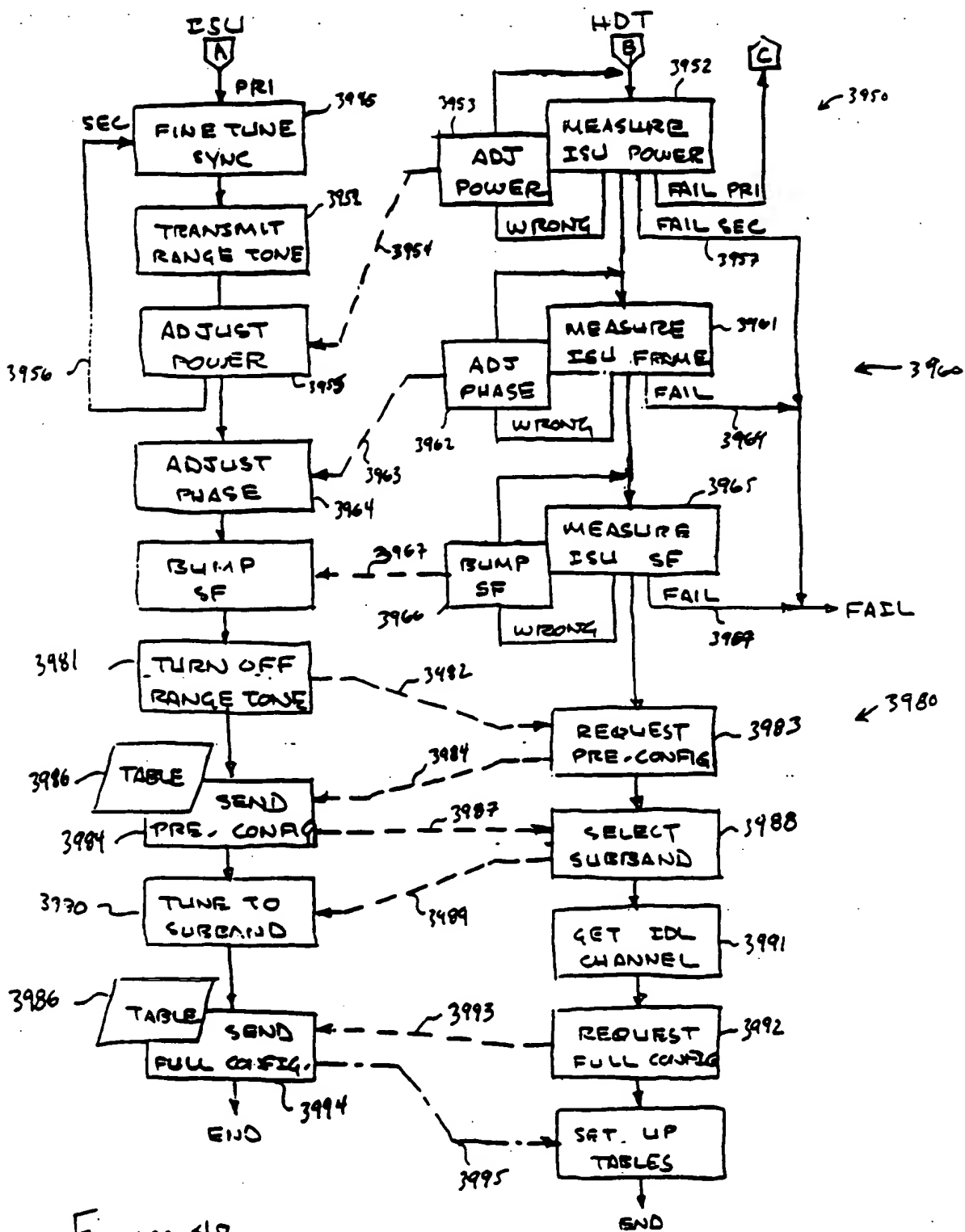


Figure 48

Figure 49 4000

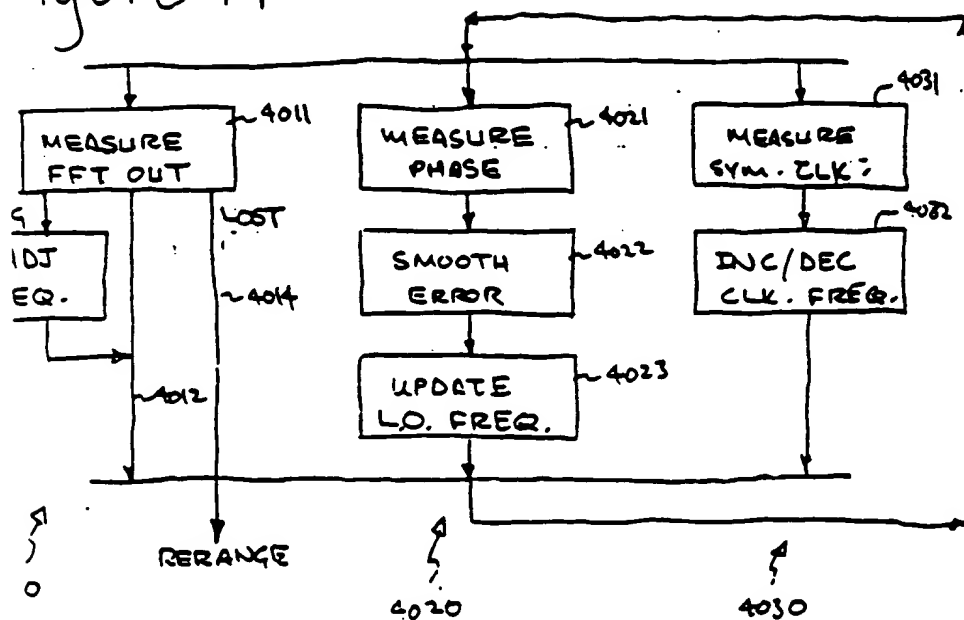
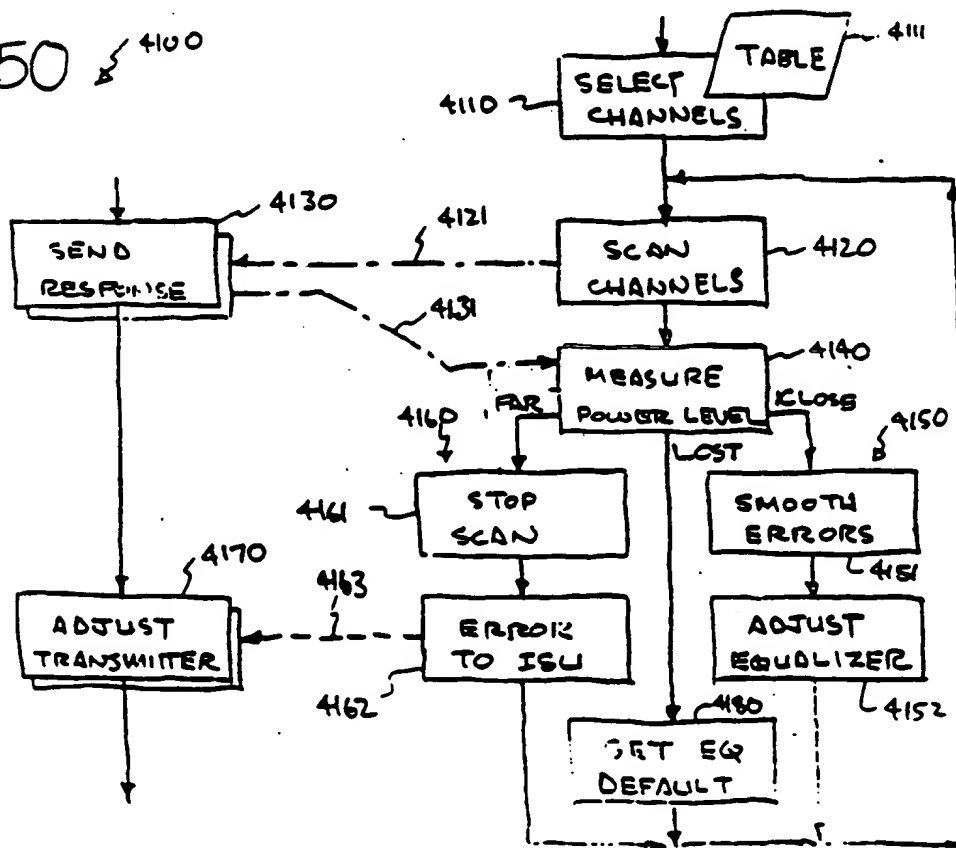


Figure 50 4100



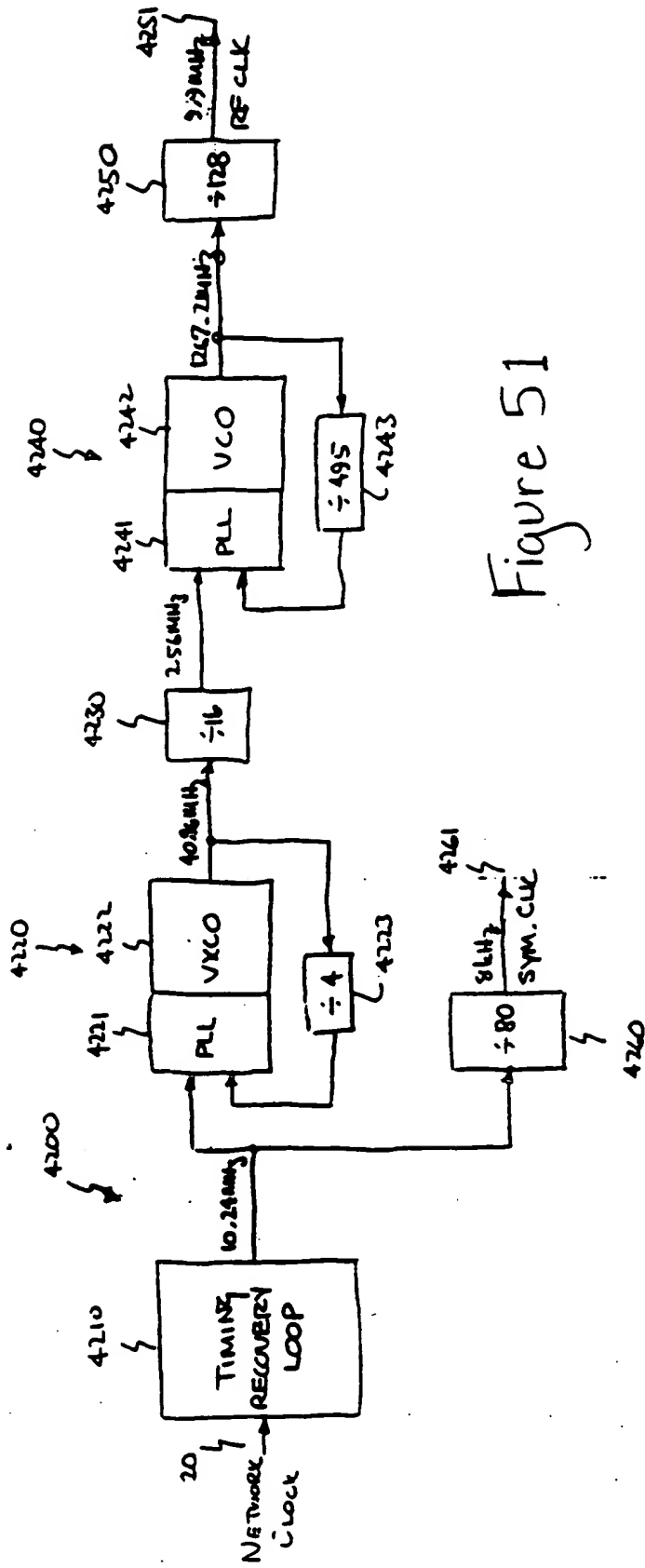


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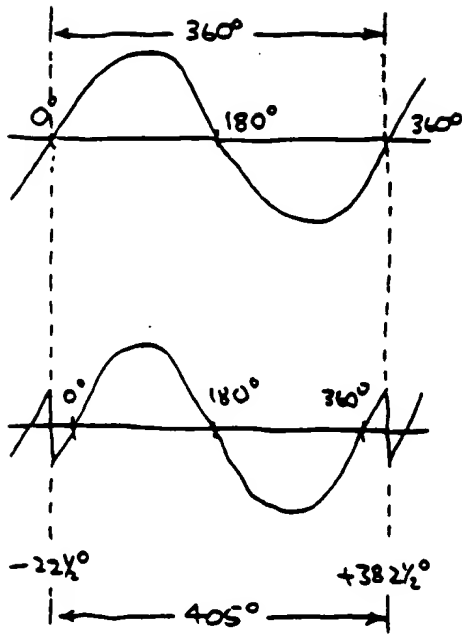


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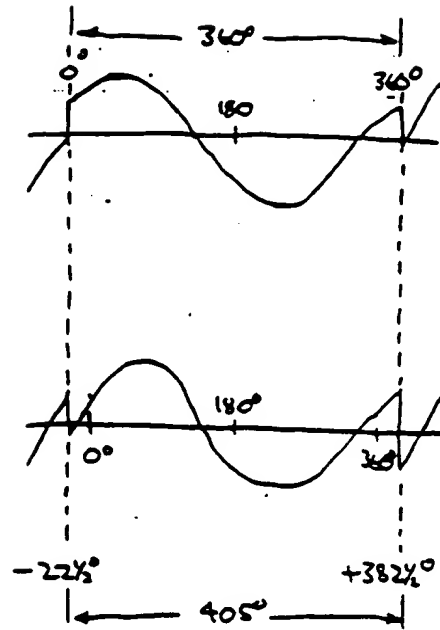


Figure 53

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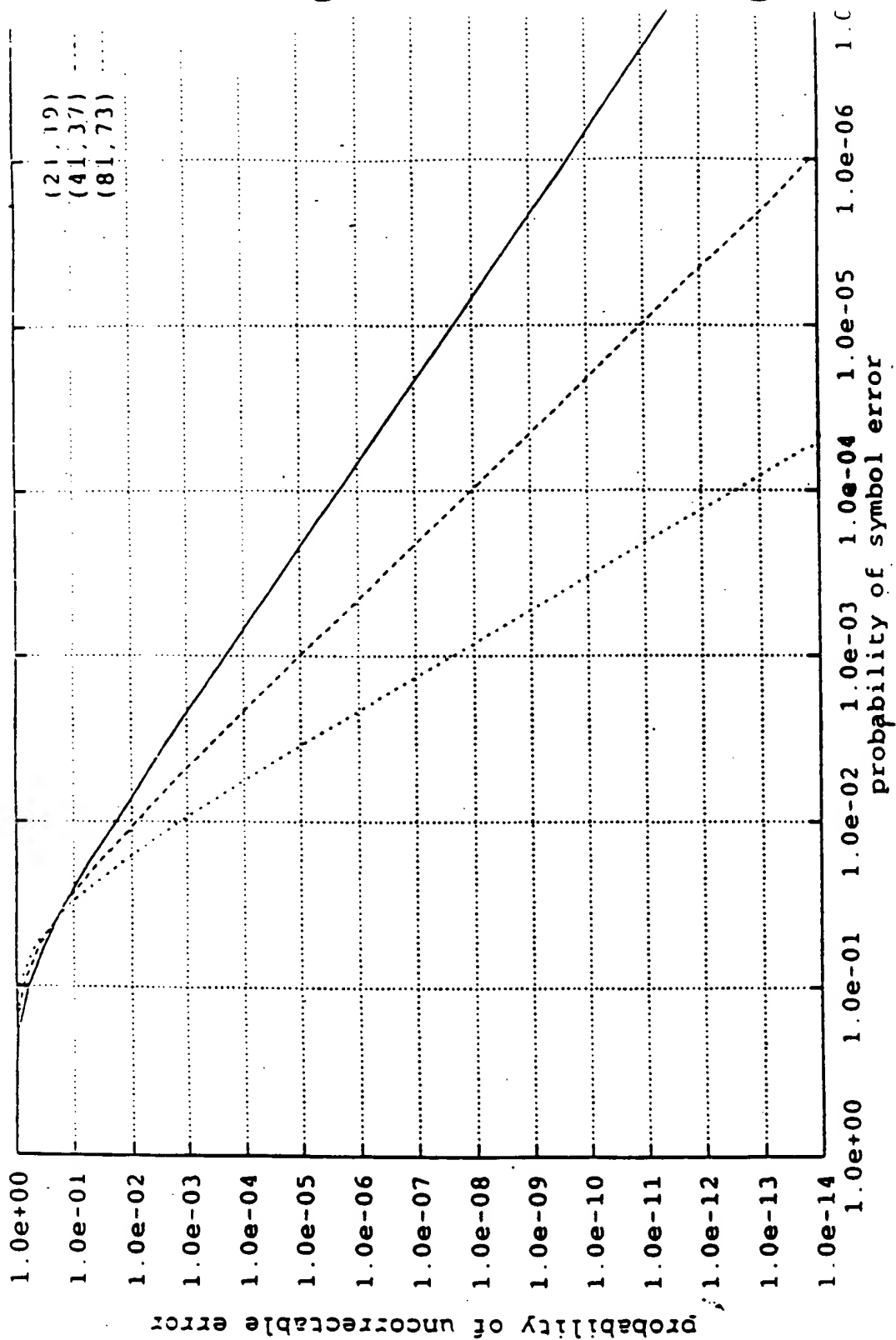


Figure 5'

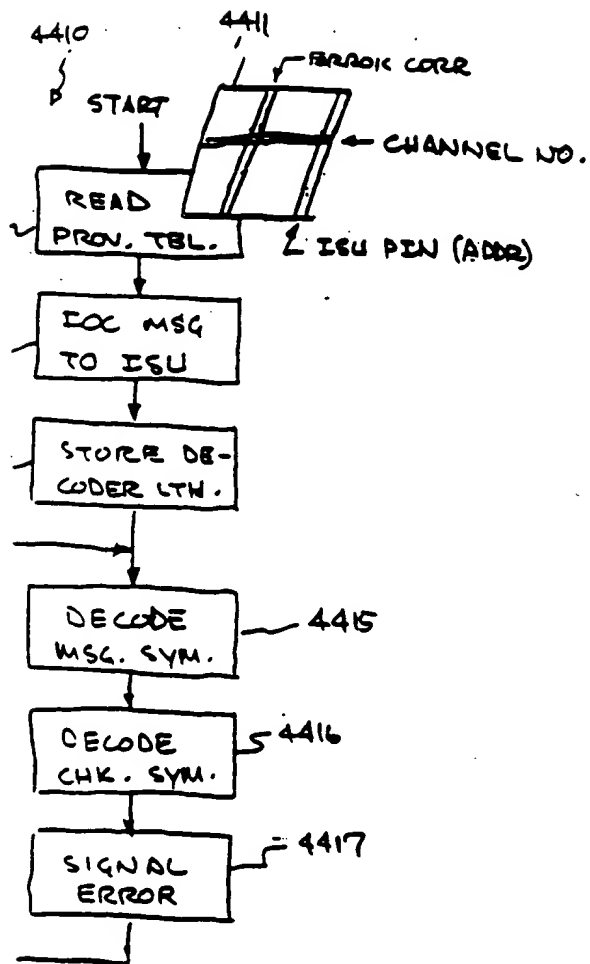


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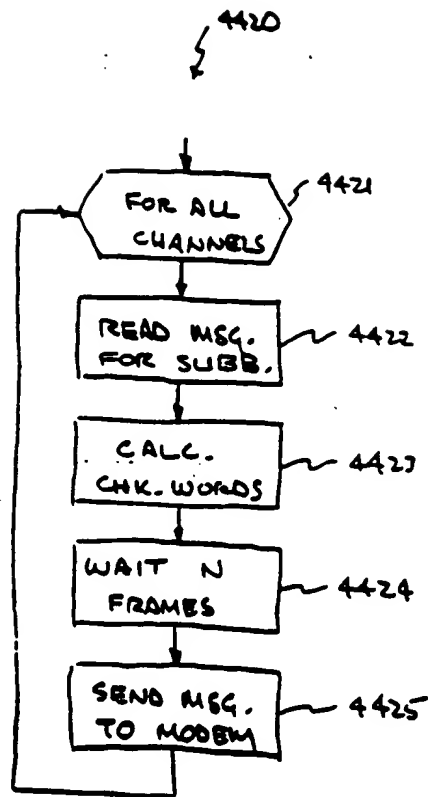


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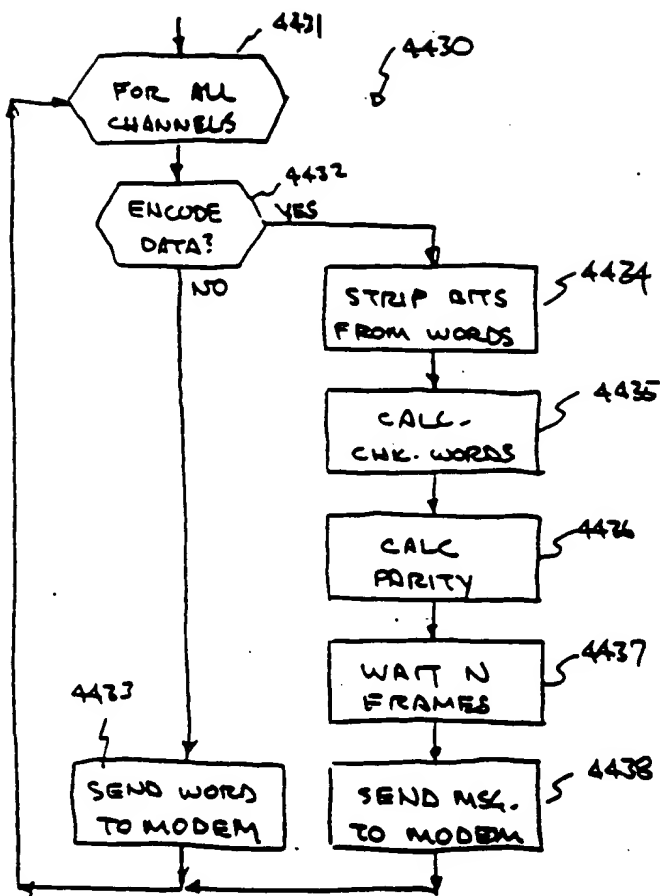


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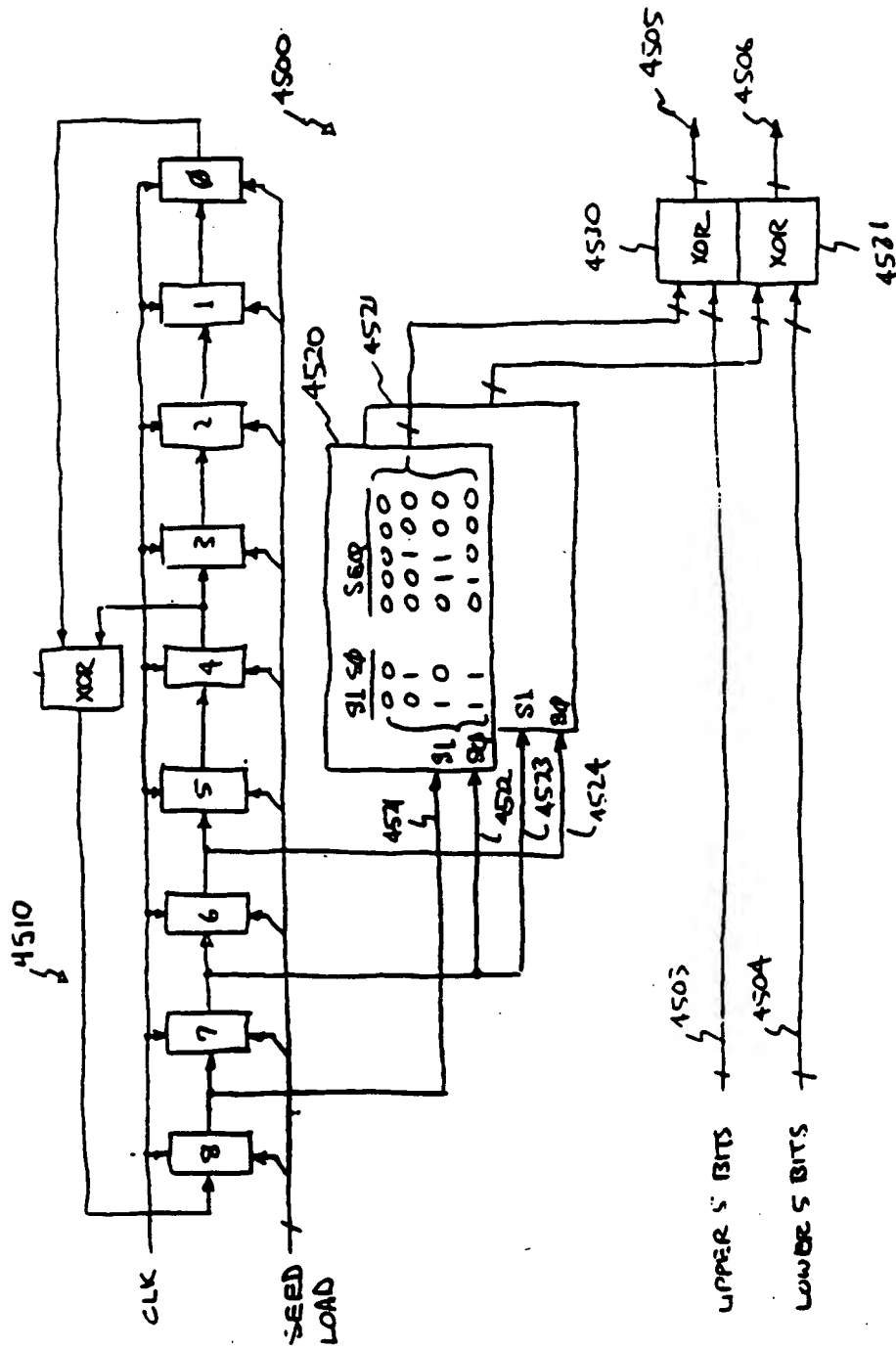


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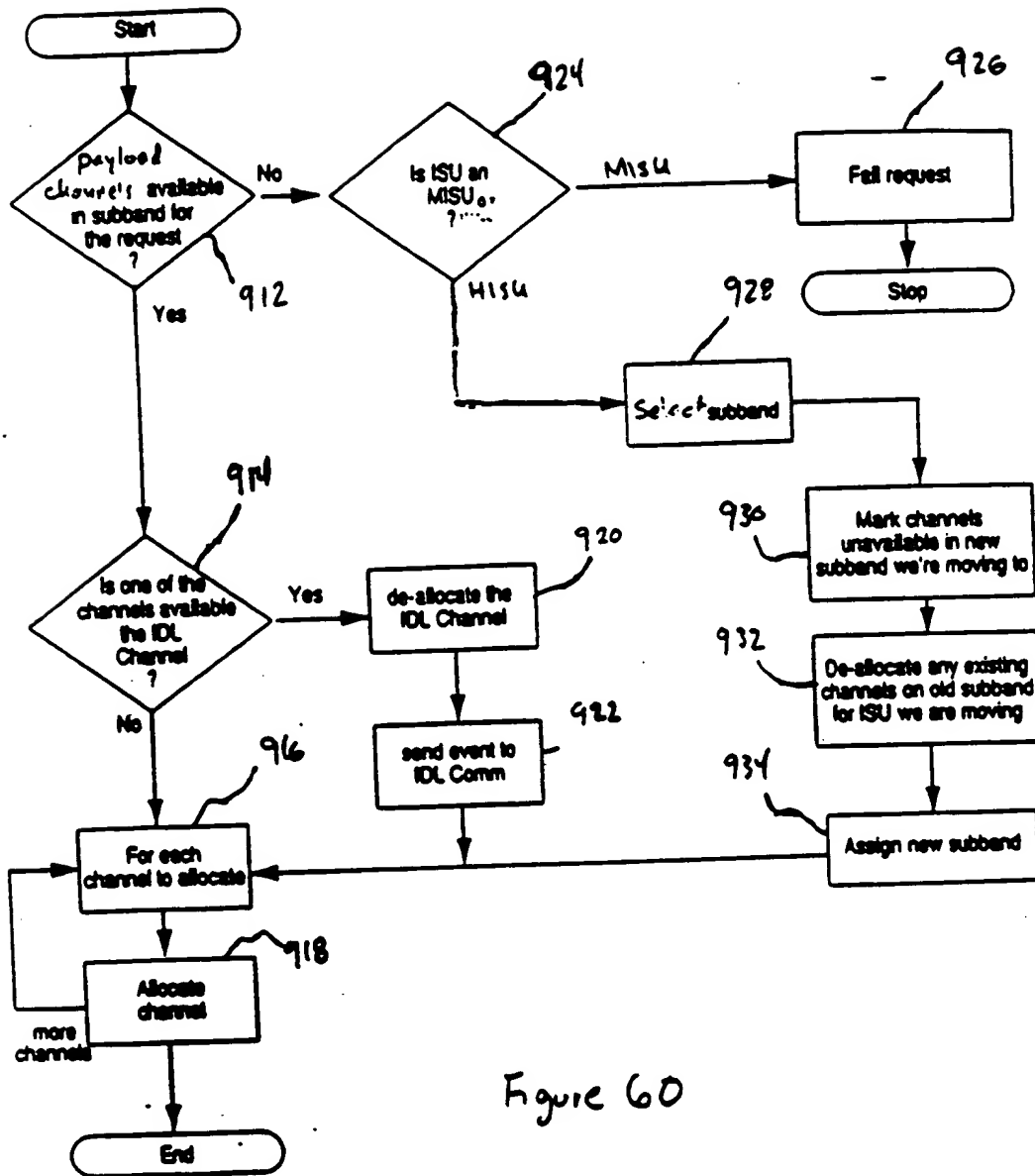


Figure 60

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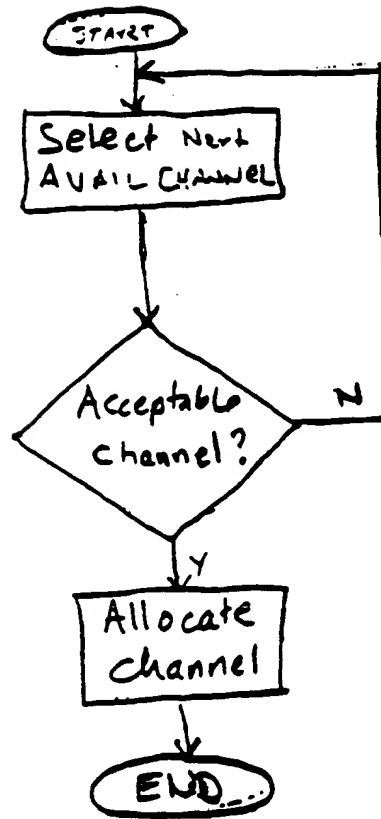


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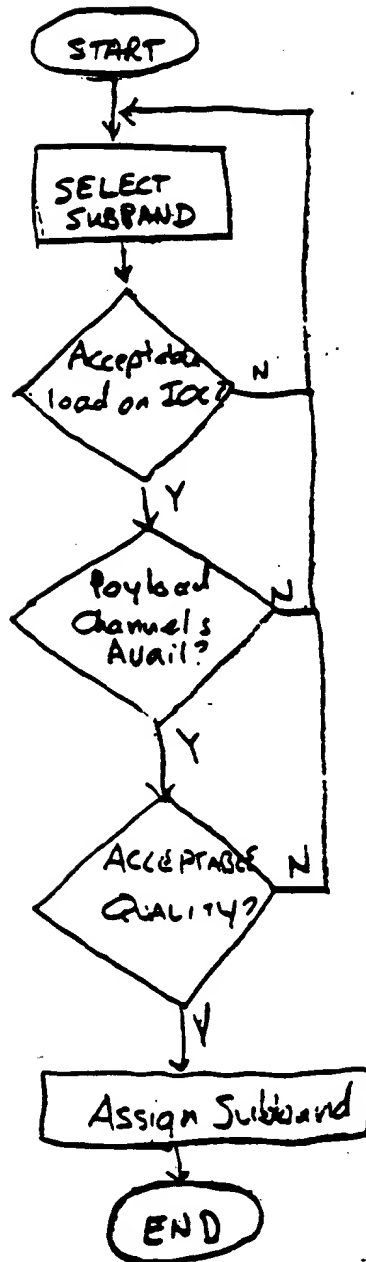


Figure 62

66960-14660

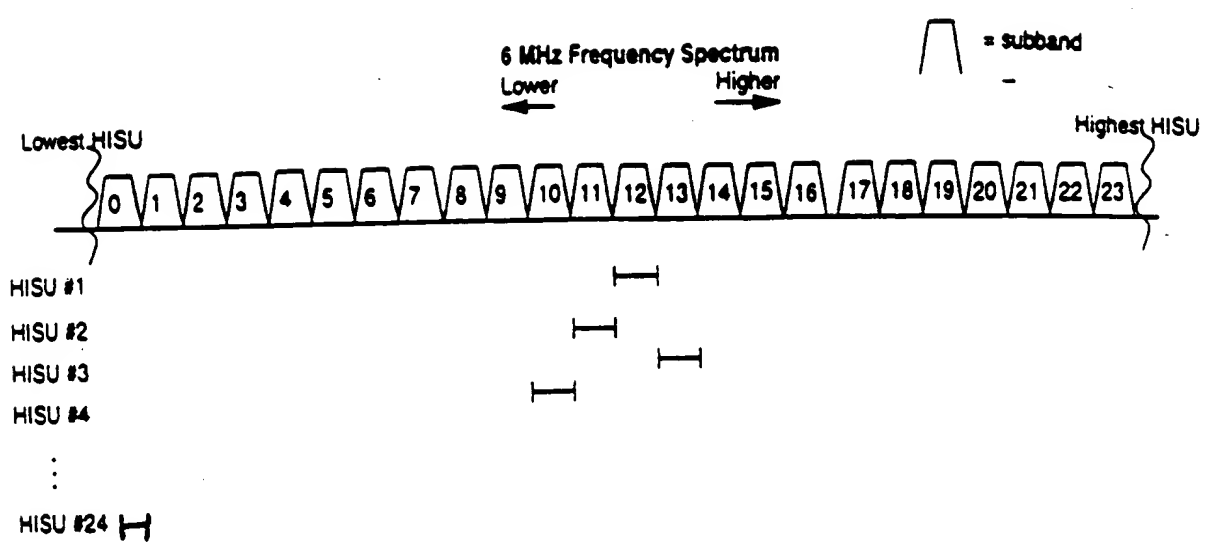


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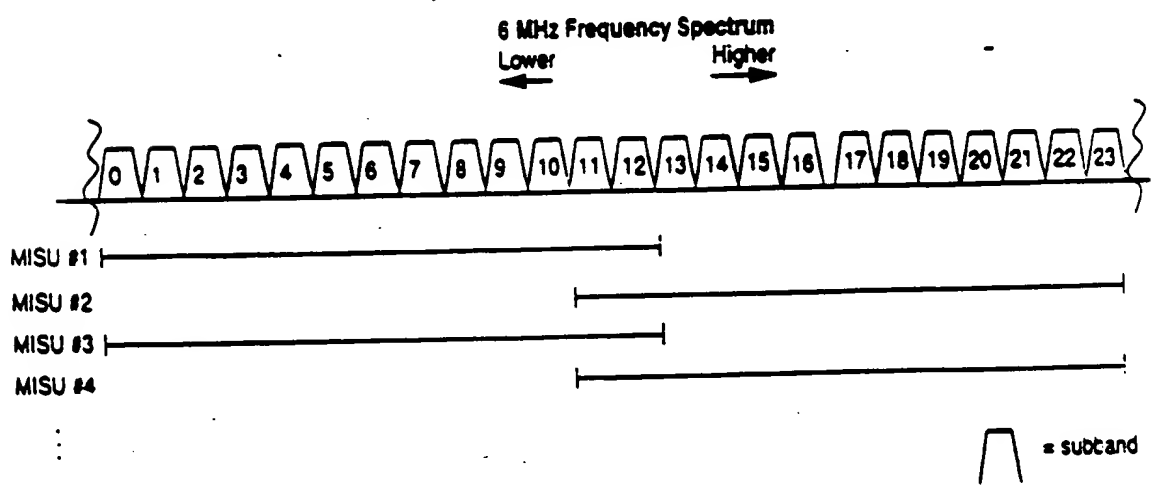


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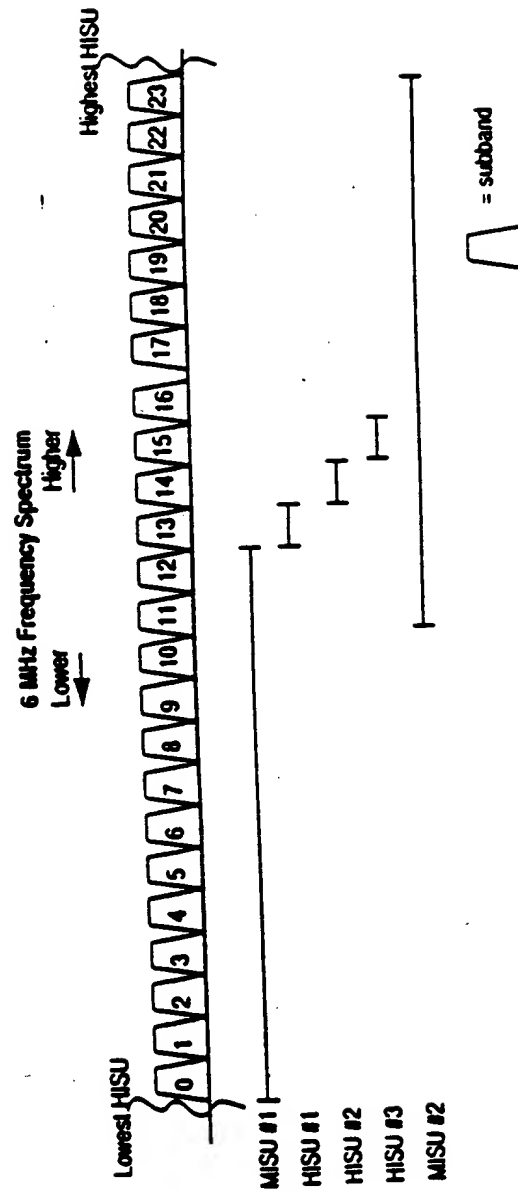


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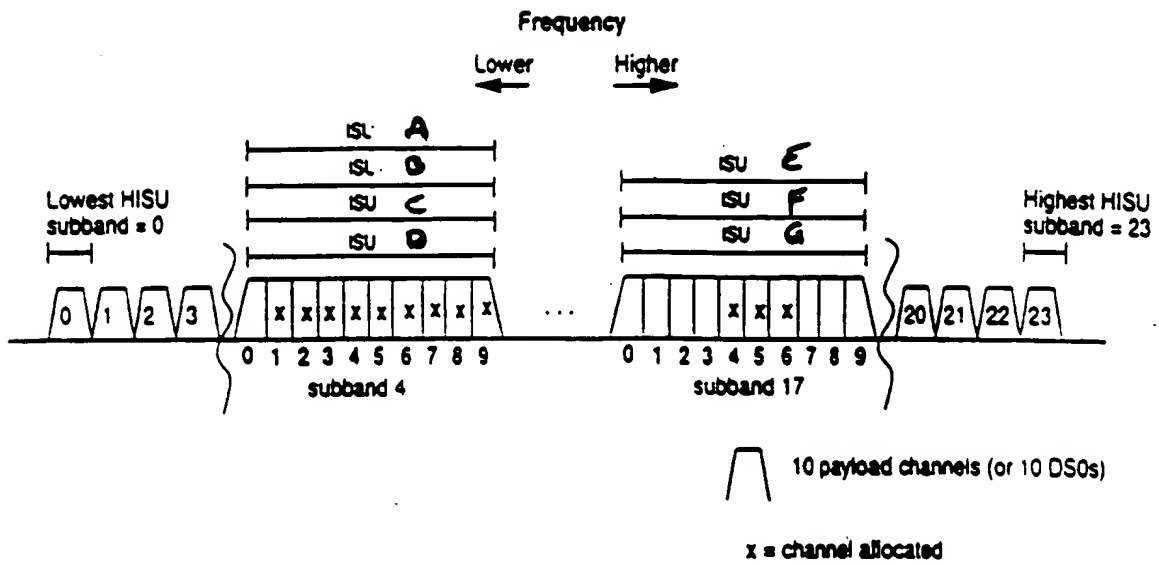


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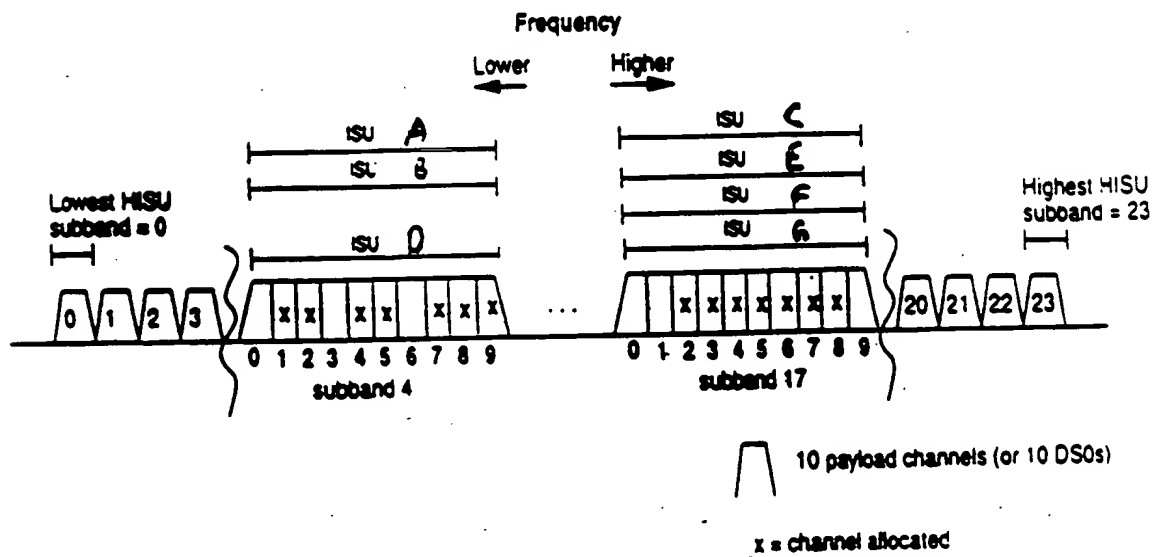


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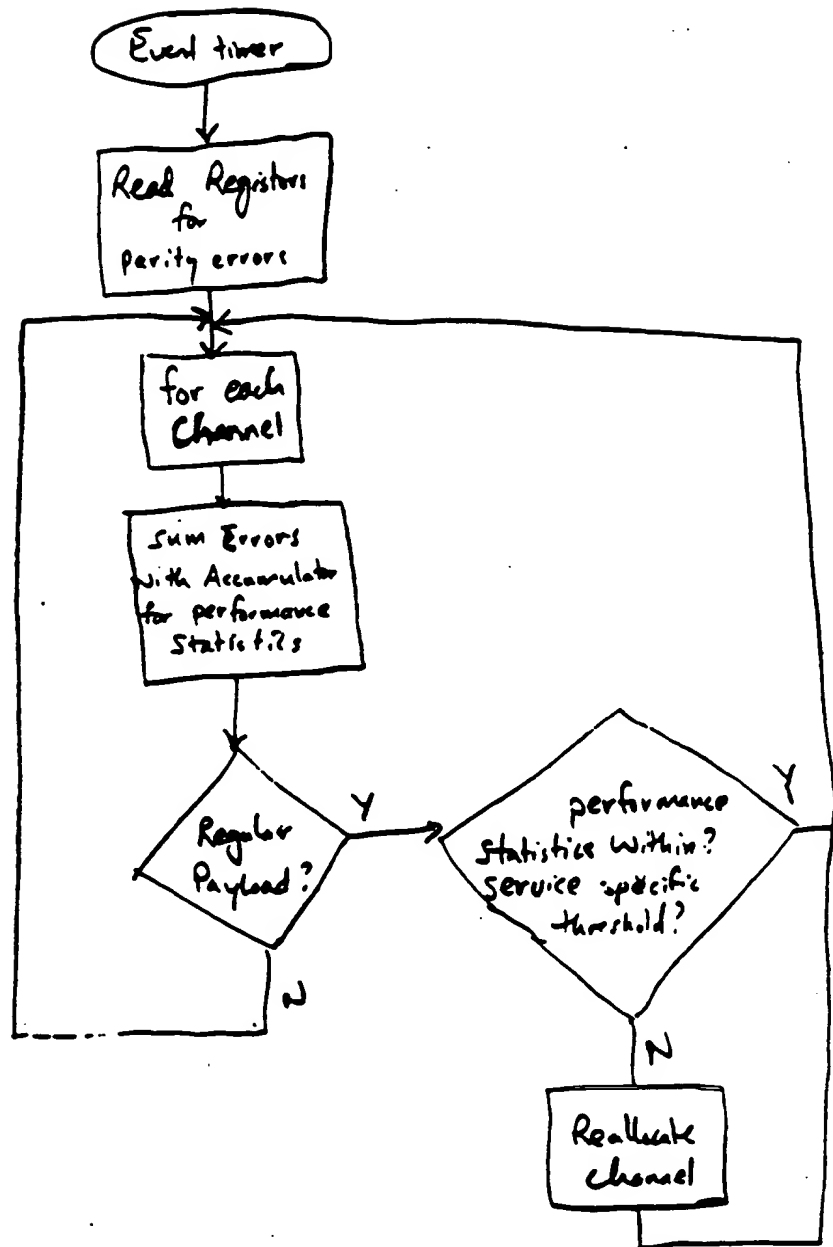


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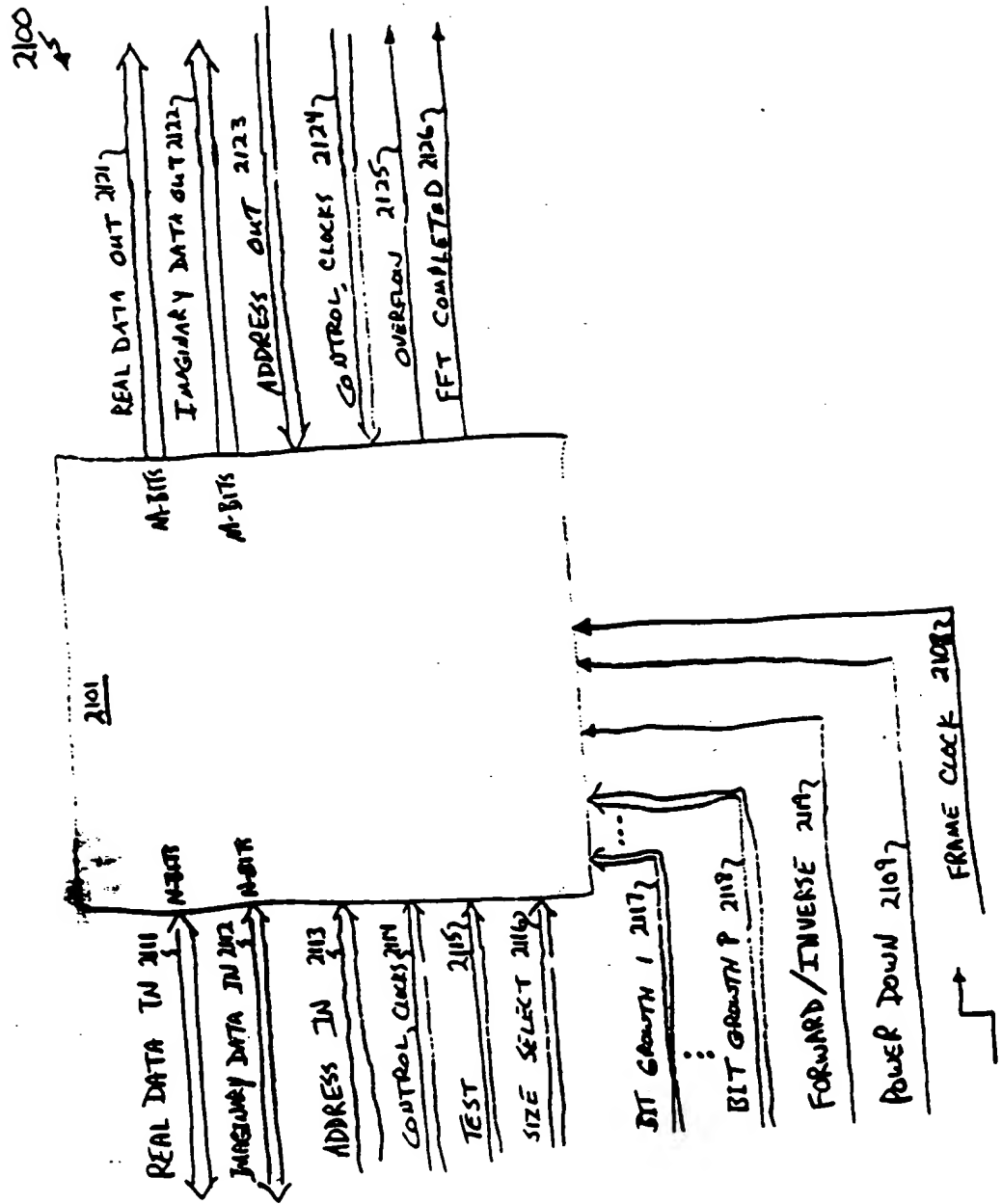


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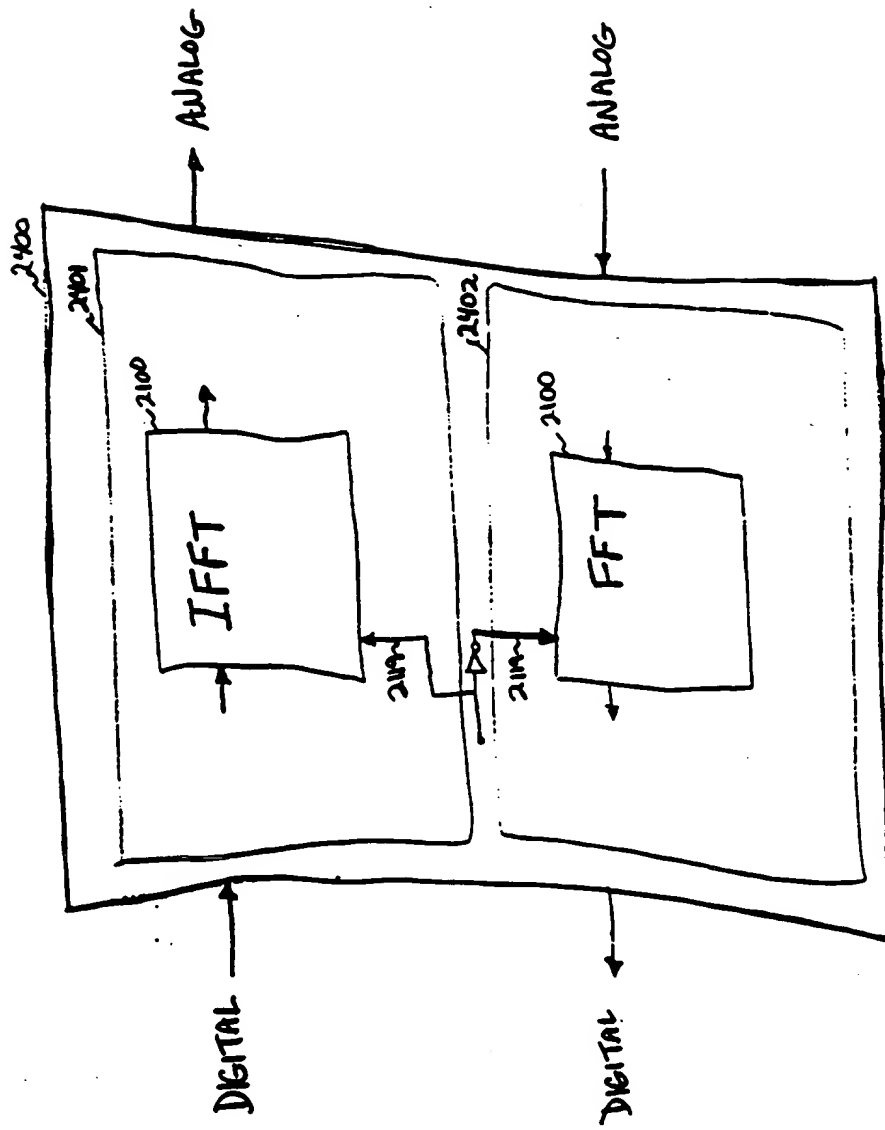


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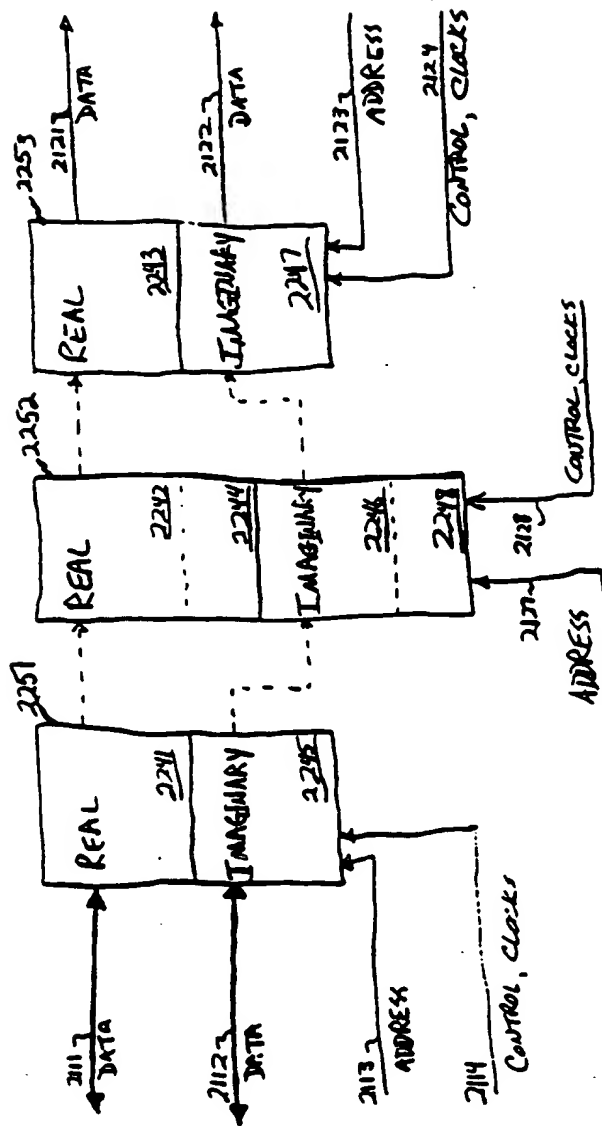


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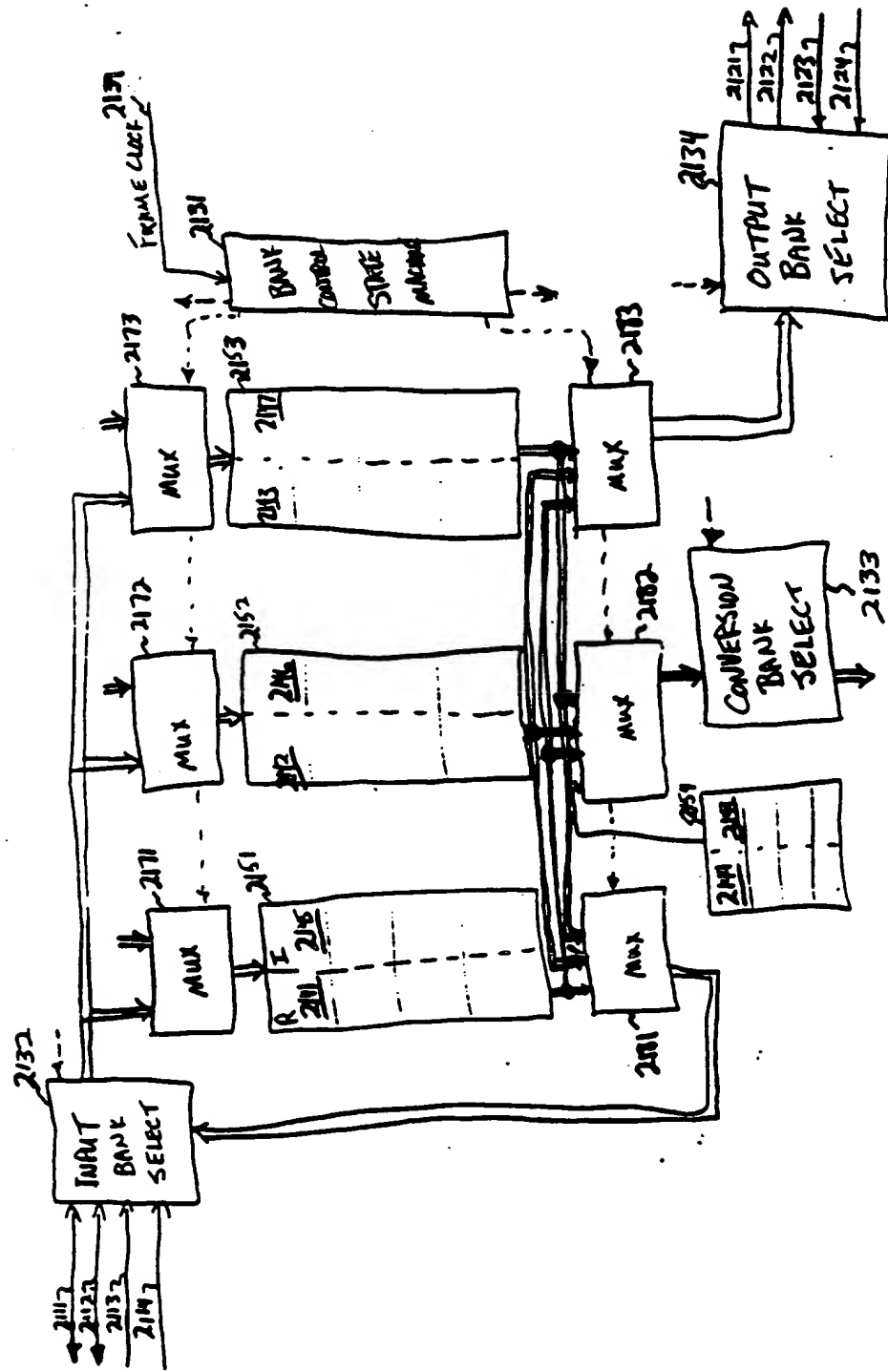


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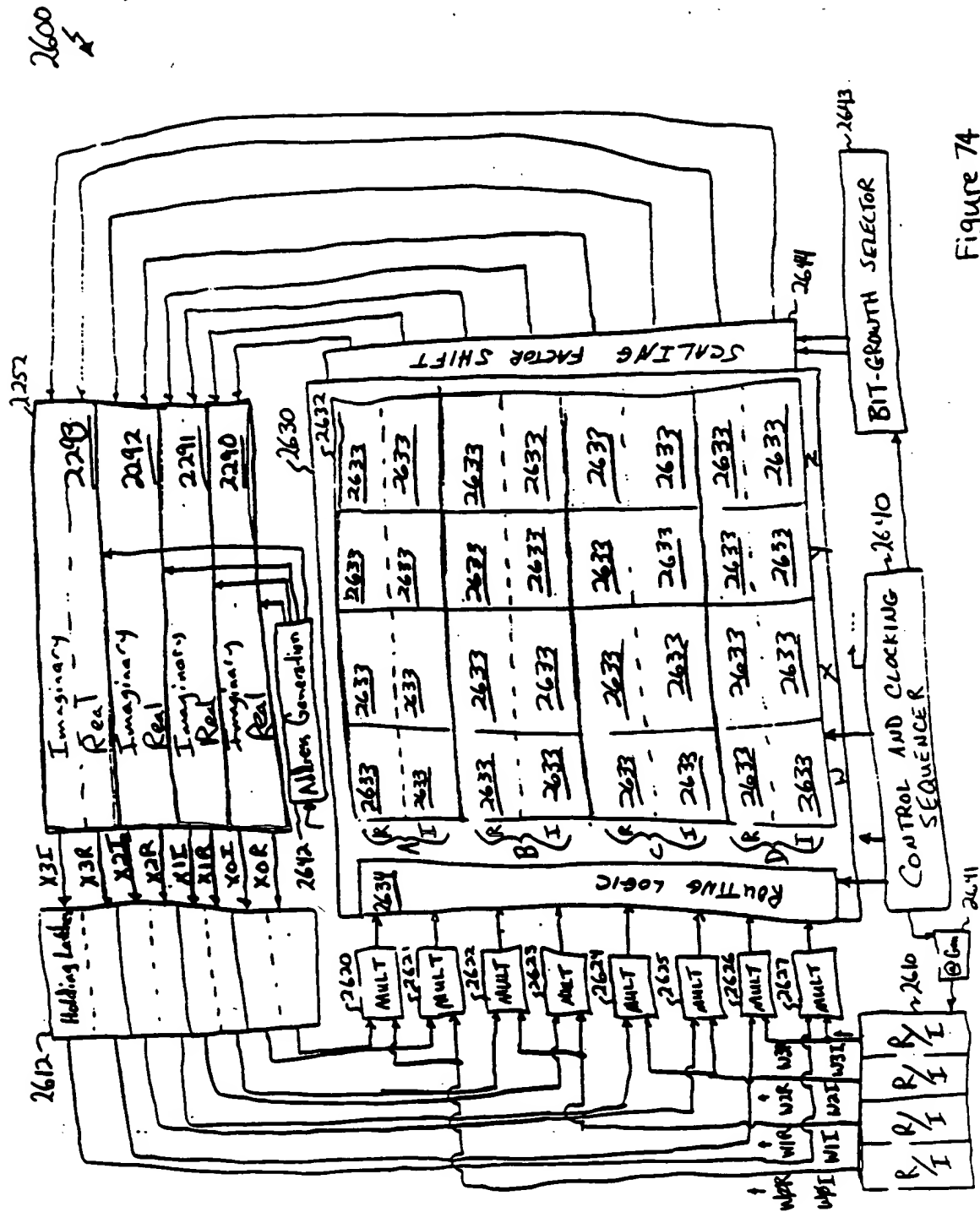


Figure 74

Figure 75 THIS TABLE SHOWS THE ORDER OF CALCULATION FOR A NORMAL BUTTERFLY:

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C_0	$AWR = WR$ $AWI = WI$	$AXR = XR$ $AXI = XI$	$AYR = YR$ $AYI = YI$	$AZR = ZR$ $AZI = ZI$
	$BWR = WR$ $BWI = WI$	$BXR = XR$ $BXI = XI$	$BYR = YR$ $BYI = YI$	$BZR = ZR$ $BZI = ZI$
	$CWR = WR$ $CWI = WI$	$CXR = XR$ $CXI = XI$	$CYR = YR$ $CYI = YI$	$CZR = ZR$ $CZI = ZI$
	$DWR = WR$ $DWI = WI$	$DXR = XR$ $DXI = XI$	$DYR = YR$ $DYI = YI$	$DZR = ZR$ $DZI = ZI$

Figure 76

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C_1	$AWR = AWR - WI$ $AWI = AWI + WR$	$AXR = AXR - XI$ $AXI = AXI + XR$	$AYR = AYR - YI$ $AYI = AYI + YR$	$AZR = AZR - ZI$ $AZI = AZI + ZR$
	$BWR = BWR - WI$ $BWI = BWI + WR$	$BXR = BXR - XI$ $BXI = BXI + XR$	$BYR = BYR - YI$ $BYI = BYI + YR$	$BZR = BZR - ZI$ $BZI = BZI + ZR$
	$CWR = CWR - WI$ $CWI = CWI + WR$	$CXR = CXR - XI$ $CXI = CXI + XR$	$CYR = CYR - YI$ $CYI = CYI + YR$	$CZR = CZR - ZI$ $CZI = CZI + ZR$
	$DWR = DWR - WI$ $DWI = DWI + WR$	$DXR = DXR - XI$ $DXI = DXI + XR$	$DYR = DYR - YI$ $DYI = DYI + YR$	$DZR = DZR - ZI$ $DZI = DZI + ZR$

Figure 77

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C2	AWR = AWR + WR AWI = AWI + WI	AXR = AXR + XI AXI = AXI - XR	AYR = AYR - YR AYI = AYI - YI	AZR = AZR - ZI AZI = AZI + ZR
	BWR = BWR + WR BWI = BWI + WI	BXR = BXR + XI BXI = BXI - XR	BYR = BYR - YR BYI = BYI - YI	BZR = BZR - ZI BZI = BZI + ZR
	CWR = CWR + WR CWI = CWI + WI	CXR = CXR + XI CXI = CXI - XR	CYR = CYR - YR CYI = CYI - YI	CZR = CZR - ZI CZI = CZI + ZR
	DWR = DWR + WR DWI = DWI + WI	DXR = DXR + XI DXI = DXI - XR	DYR = DYR - YR DYI = DYI - YI	DZR = DZR - ZI DZI = DZI + ZR

Figure 78

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C3	AWR = AWR - WI AWI = AWI + WR	AXR = AXR + XR AXI = AXI + XI	AYR = AYR + YI AYI = AYI - YR	AZR = AZR - ZR AZI = AZI - ZI
	BWR = BWR - WI BWI = BWI + WR	BXR = BXR + XR BXI = BXI + XI	BYR = BYR + YI BYI = BYI - YR	BZR = BZR - ZR BZI = BZI - ZI
	CWR = CWR - WI CWI = CWI + WR	CXR = CXR + XR CXI = CXI + XI	CYR = CYR + YI CYI = CYI - YR	CZR = CZR - ZR CZI = CZI - ZI
	DWR = DWR - WI DWI = DWI + WR	DXR = DXR + XR DXI = DXI + XI	DYR = DYR + YI DYI = DYI - YR	DZR = DZR - ZR DZI = DZI - ZI

Figure 79

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$AWR = AWR + WR$ $AWI = AWI + WI$	$AXR = AXR - XR$ $AXI = AXI - XI$	$AYR = AYR + YR$ $AYI = AYI + YI$	$AZR = AZR - ZR$ $AZI = AZI - ZI$
$BWR = BWR + WR$ $BWI = BWI + WI$	$BXR = BXR - XR$ $BXI = BXI - XI$	$BYR = BYR + YR$ $BYI = BYI + YI$	$BZR = BZR - ZR$ $BZI = BZI - ZI$
$CWR = CWR + WR$ $CWI = CWI + WI$	$CXR = CXR - XR$ $CXI = CXI - XI$	$CYR = CYR + YR$ $CYI = CYI + YI$	$CZR = CZR - ZR$ $CZI = CZI - ZI$
$DWR = DWR + WR$ $DWI = DWI + WI$	$DXR = DXR - XR$ $DXI = DXI - XI$	$DYR = DYR + YR$ $DYI = DYI + YI$	$DZR = DZR - ZR$ $DZI = DZI - ZI$

Figure 80

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$AWR = AWR - WI$ $AWI = AWI + WR$	$AXR = AXR + XI$ $AXI = AXI - XR$	$AYR = AYR - YI$ $AYI = AYI + YR$	$AZR = AZR + ZI$ $AZI = AZI - ZR$
$BWR = BWR - WI$ $BWI = BWI + WR$	$BXR = BXR + XI$ $BXI = BXI - XR$	$BYR = BYR - YI$ $BYI = BYI + YR$	$BZR = BZR + ZI$ $BZI = BZI - ZR$
$CWR = CWR - WI$ $CWI = CWI + WR$	$CXR = CXR + XI$ $CXI = CXI - XR$	$CYR = CYR - YI$ $CYI = CYI + YR$	$CZR = CZR + ZI$ $CZI = CZI - ZR$
$DWR = DWR - WI$ $DWI = DWI + WR$	$DXR = DXR + XI$ $DXI = DXI - XR$	$DYR = DYR - YI$ $DYI = DYI + YR$	$DZR = DZR + ZI$ $DZI = DZI - ZR$

Figure 81

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C_6	$AWR = AWR + WR$ $AWI = AWI + WI$	$AXR = AXR - XI$ $AXI = AXI + XR$	$AYR = AYR - YR$ $AYI = AYI - YI$	$AZR = AZR + ZI$ $AZI = AZI - ZR$
	$BWR = BWR + WR$ $BWI = BWI + WI$	$BXR = BXR - XI$ $BXI = BXI + XR$	$BYR = BYR - YR$ $BYI = BYI - YI$	$BZR = BZR + ZI$ $BZI = BZI - ZR$
	$CWR = CWR + WR$ $CWI = CWI + WI$	$CXR = CXR - XI$ $CXI = CXI + XR$	$CYR = CYR - YR$ $CYI = CYI - YI$	$CZR = CZR + ZI$ $CZI = CZI - ZR$
	$DWR = DWR + WR$ $DWI = DWI + WI$	$DXR = DXR - XI$ $DXI = DXI + XR$	$DYR = DYR - YR$ $DYI = DYI - YI$	$DZR = DZR + ZI$ $DZI = DZI - ZR$

Figure 82

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2632

C_7	$AWR = AWR - WI$ $AWI = AWI + WR$	$AXR = AXR - XR$ $AXI = AXI - XI$	$AYR = AYR + YI$ $AYI = AYI - YR$	$AZR = AZR - ZR$ $AZI = AZI + ZI$
	$BWR = BWR - WI$ $BWI = BWI + WR$	$BXR = BXR - XR$ $BXI = BXI - XI$	$BYR = BYR + YI$ $BYI = BYI - YR$	$BZR = BZR - ZR$ $BZI = BZI + ZI$
	$CWR = CWR - WI$ $CWI = CWI + WR$	$CXR = CXR - XR$ $CXI = CXI - XI$	$CYR = CYR + YI$ $CYI = CYI - YR$	$CZR = CZR - ZR$ $CZI = CZI + ZI$
	$DWR = DWR - WI$ $DWI = DWI + WR$	$DXR = DXR - XR$ $DXI = DXI - XI$	$DYR = DYR + YI$ $DYI = DYI - YR$	$DZR = DZR - ZR$ $DZI = DZI + ZI$

Figure 83

THIS TABLE SHOWS THE ORDER OF CALCULATION FOR A TRANSPOSED BUTTERFLY:

2010

2632

C0	$AWR = WR + XR + YR + ZR$ $AWI = WI + XI + YI + ZI$	$AXR = WR \cdot XI - YR \cdot ZI$ $AXI = WI + XR - YI - ZR$	$AYR = WR \cdot XR + YR \cdot ZR$ $AYI = WI \cdot XI + YI \cdot ZI$	$AZR = WR + XI - YR - ZI$ $AZI = WI \cdot XR - YI + ZR$
.
.
.
.

Figure 84

2810

2632

C1	$AWR = AWR \cdot (WI + XI + YI + ZI)$ $AWI = AWI \cdot (WR + XR + YR + ZR)$	$AXR = AXR \cdot (WI + XR - YI - ZR)$ $AXI = AXI \cdot (WR - XI - YR + ZI)$	$AYR = AYR \cdot (WI - XI + YI - ZI)$ $AYI = AYI \cdot (WR \cdot XR + YR \cdot ZR)$	$AZR = AZR \cdot (WI \cdot XR - YI + ZR)$ $AZI = AZI \cdot (WR + XI - YR - ZI)$
.
.
.
.

Figure 85

2810
2632

C2	.	.	.	.
	$BWR = WR + XR + YR + ZR$ $BWI = WI + XI + YI + ZI$	$BXR = WR - XI - YR + ZI$ $BXI = WI + XR - YI - ZR$	$BYR = WR - XR + YR - ZR$ $BYI = WI - XI + YI - ZI$	$BZR = WR + XI - YR - ZI$ $BZI = WI - XR - YI + ZR$
.
.

Figure 86

2810
2632

C3	.	.	.	.
	$BWR = BWR - (WI + XI + YI + ZI)$ $BWI = DWI + (WR + XR + YR + ZR)$	$BXR = BXR - (WI + XR - YI - ZR)$ $DXI = DXI + (WR - XI - YR + ZI)$	$BYR = BYR - (WI - XI + YI - ZI)$ $BYI = BYI + (WR - XR + YR - ZR)$	$BZR = BZR - (WI - XR - YI - ZR)$ $BZI = BZI + (WR + XI - YR - ZI)$
.
.

Figure 87

2810
2632

C4	.	.	.	.
.
.
.
CWR = WR + XR + YR + ZR CWY = WY + XY + YI + ZI	CXR = WR - XI - YR + ZI CXI = WI + XR - YI - ZR	CYR = WR - XR + YR - ZR CYI = WI - XI + YI - ZI	CZR = WR + XI - YR - ZI CZI = WI - XR - YI + ZR	.

Figure 88

2810
2632

C5	.	.	.	.
.
.
.
CWR = CWR - (WI + XI + YI + ZI) CWY = CWY + (WR + XR + YR + ZR)	CXR = CXR - (WI + XR - YI - ZR) CXI = CXI + (WR - XI - YR + ZI)	CYR = CYR - (WI - XI + YI - ZI) CYI = CYI + (WR - XR + YR - ZR)	CZR = CZR - (WI - XR - YI - ZR) CZI = CZI + (WR + XI - YR - ZI)	.

Figure 89

2810

2632

C6	.	.	.	.	.
.
.
.
.
.
DWR = WR + XR + YR + ZR	DXR = WR - XI - YR + ZI	DYR = WR - XR + YR - ZR	DZR = WR + XI - YR - ZI		
DWI = WI + XI + YI + ZI	DXI = WI + XR - YI - ZR	DYI = WI - XI + YI - ZI	DZI = WI - XR - YI + ZR		

Figure 90

2810

2632

C7	.	.	.	.	.
.
.
.
.
.
DWR = DWR - (WI + XI + YI + ZI)	DXR = DXR - (WI + XR - YI - ZR)	DYR = DYR - (WI - XI + YI - ZI)	DZR = DZR - (WI - XR - YI + ZR)		
DWI = DWI + (WR + XR + YR + ZR)	DXI = DXI + (WR - XI - YR + ZI)	DYI = DYI + (WR - XR + YR - ZR)	DZI = DZI + (WR + XI - YR - ZI)		

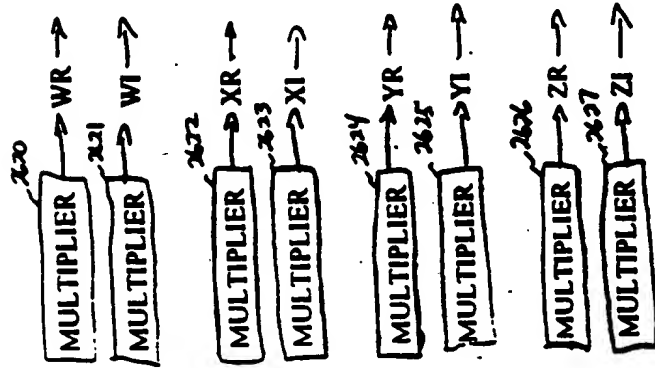
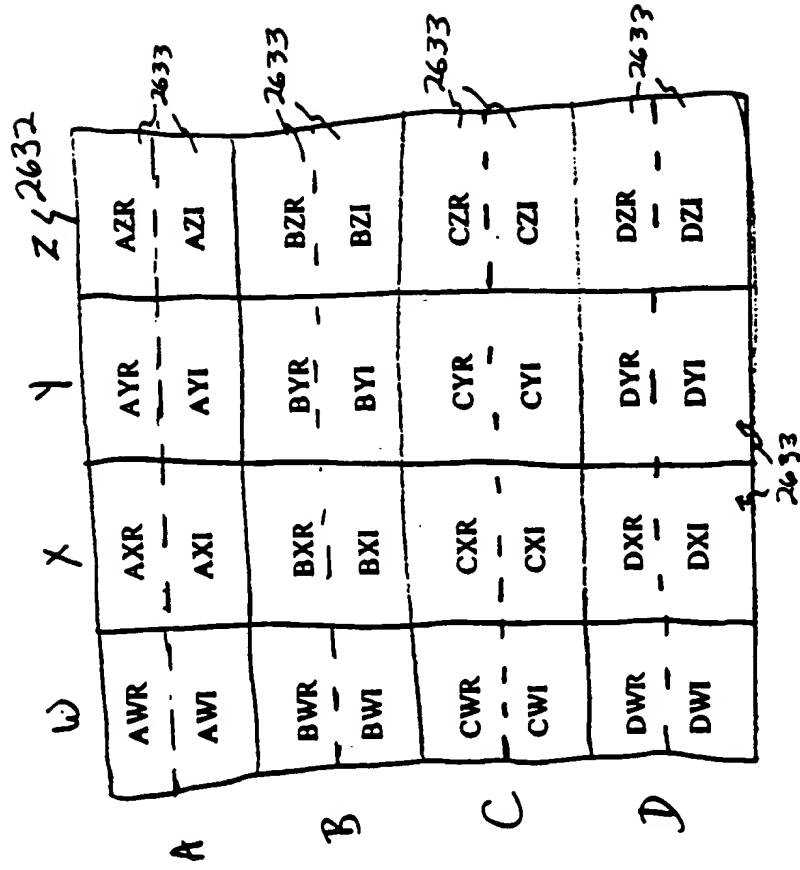


Figure 91

665760" 42E6E60

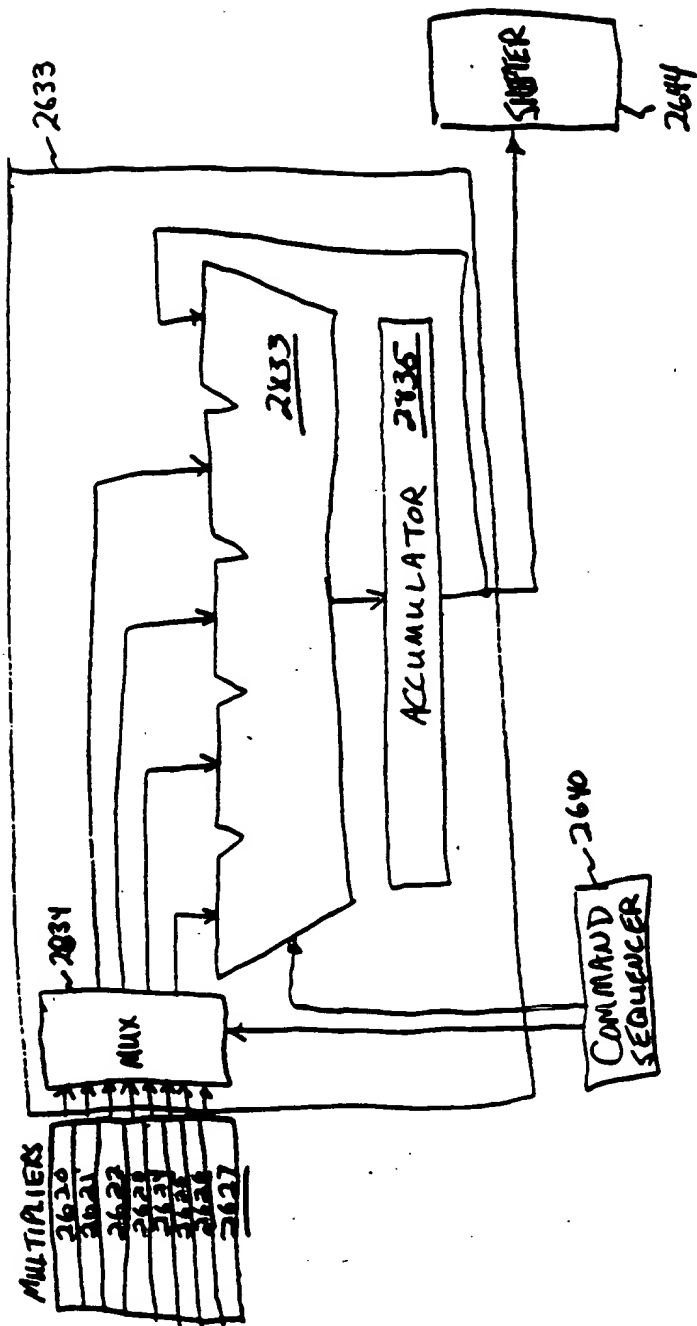


Figure 92

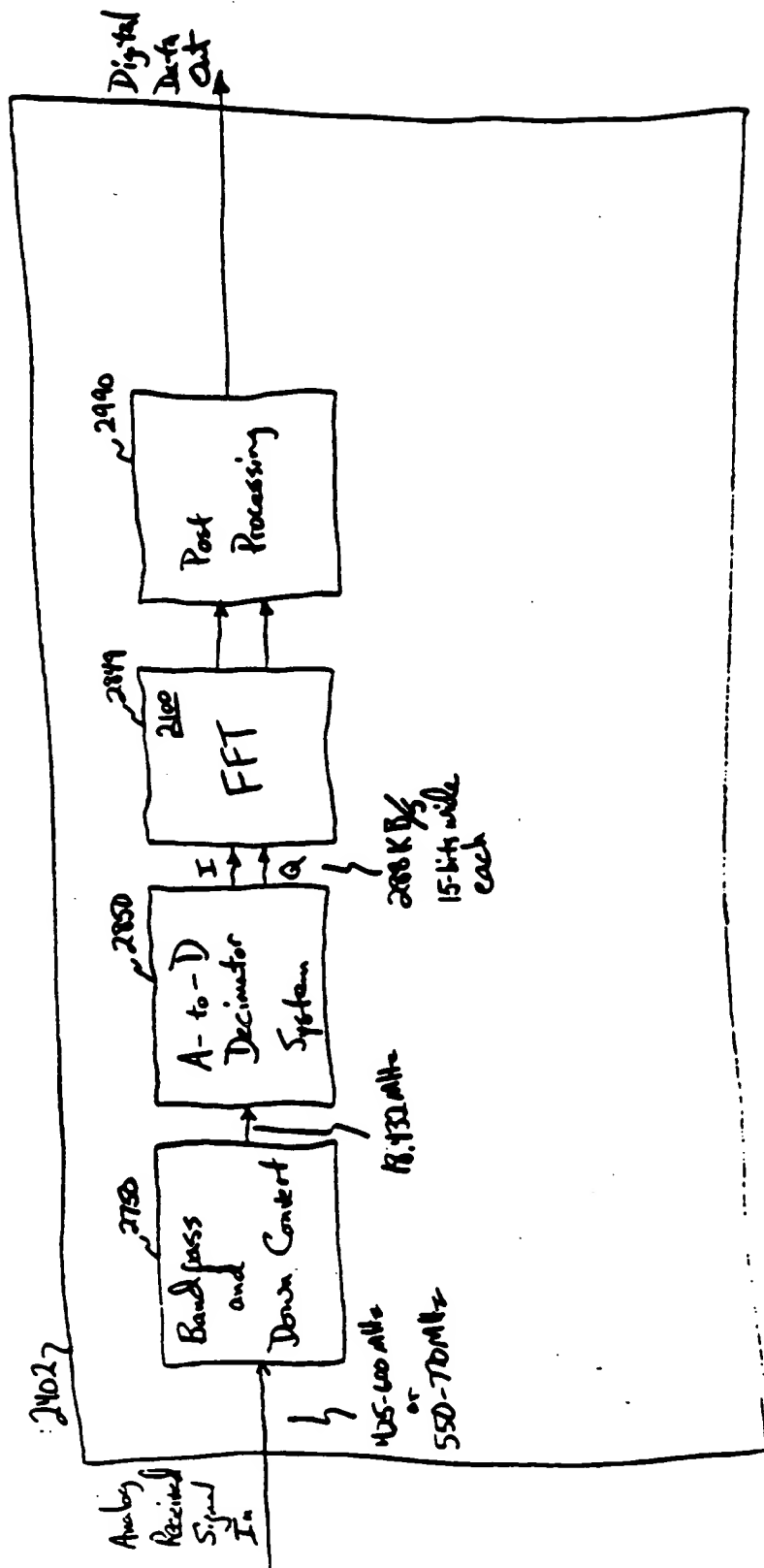


Figure 93

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099	2100
1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099	2100	

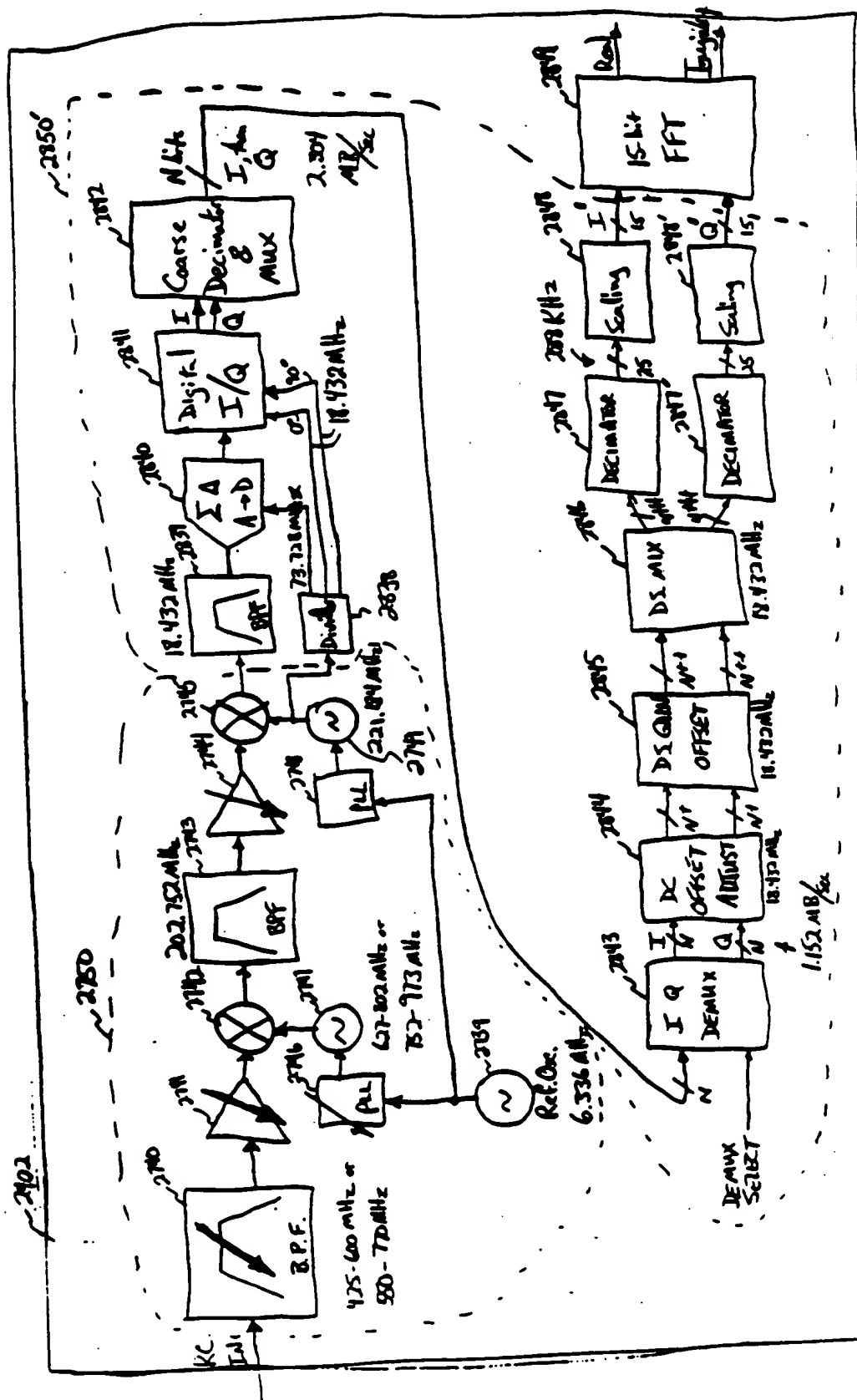


Figure 94

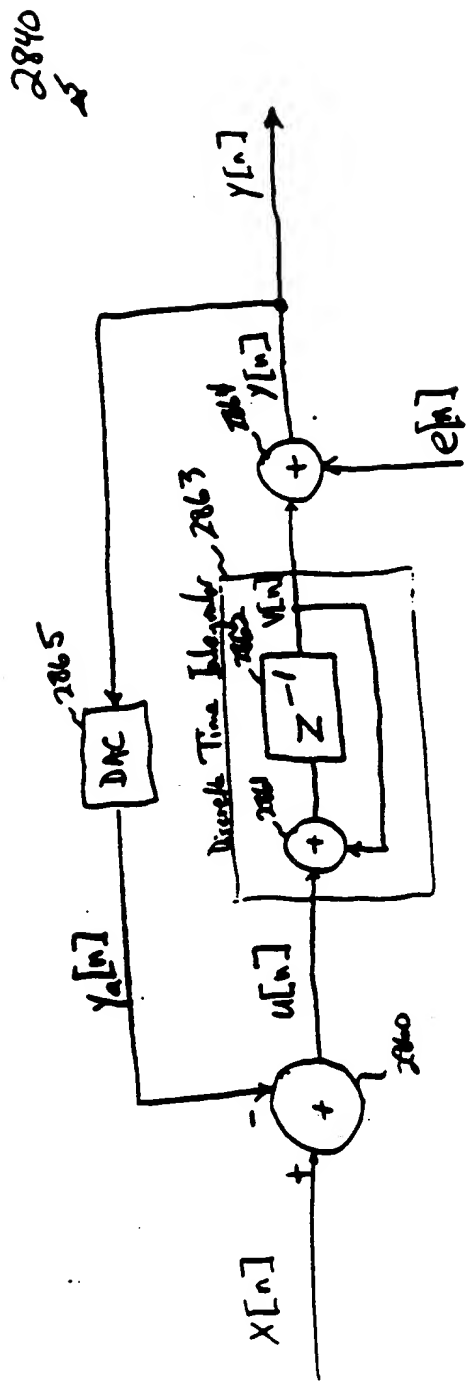
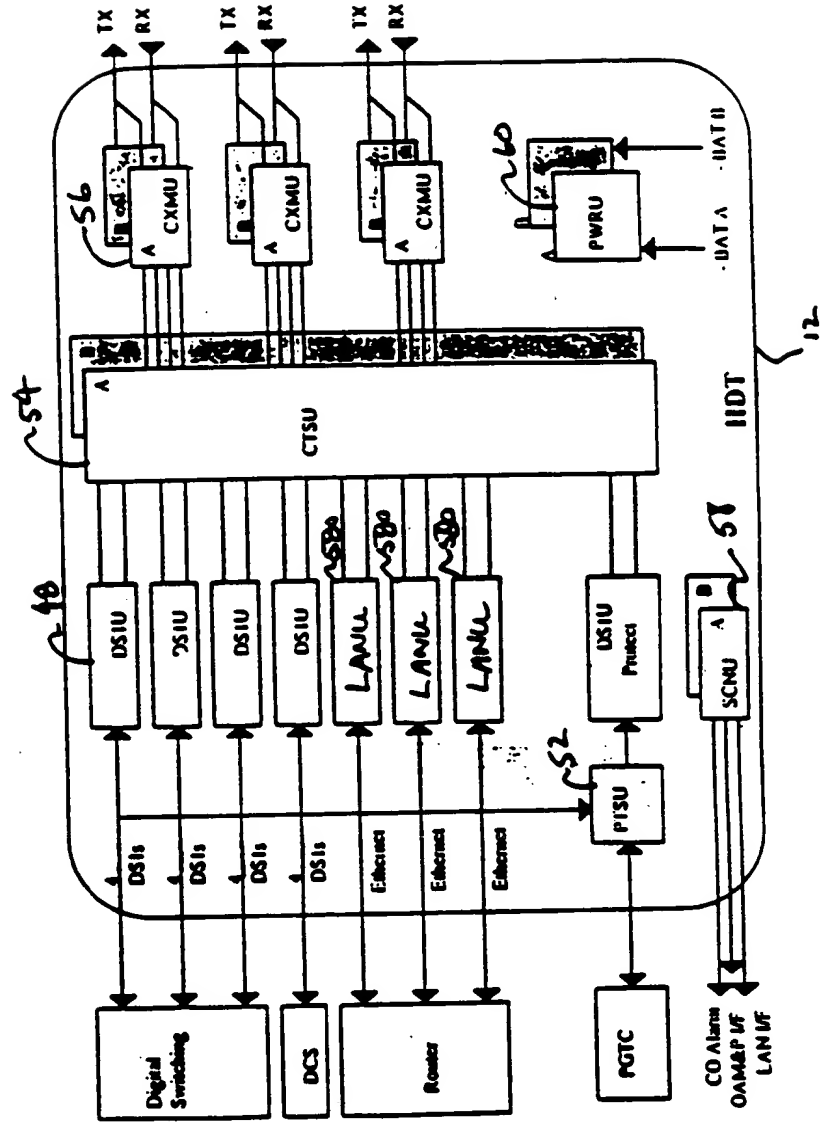


Figure 95

Figure 97



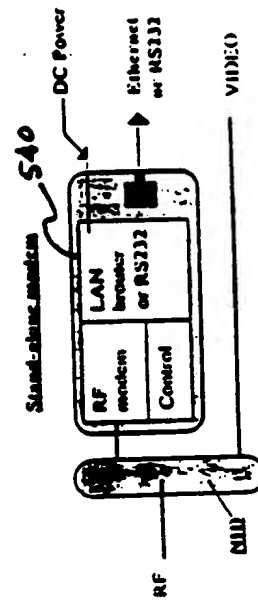
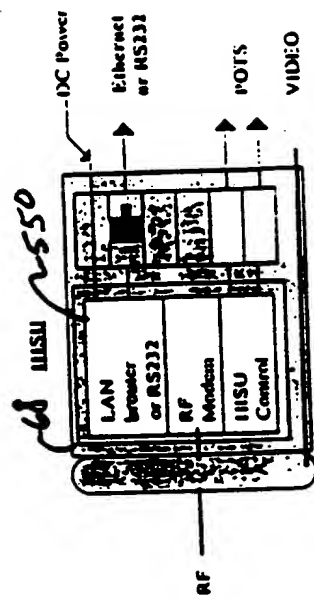


Figure 98

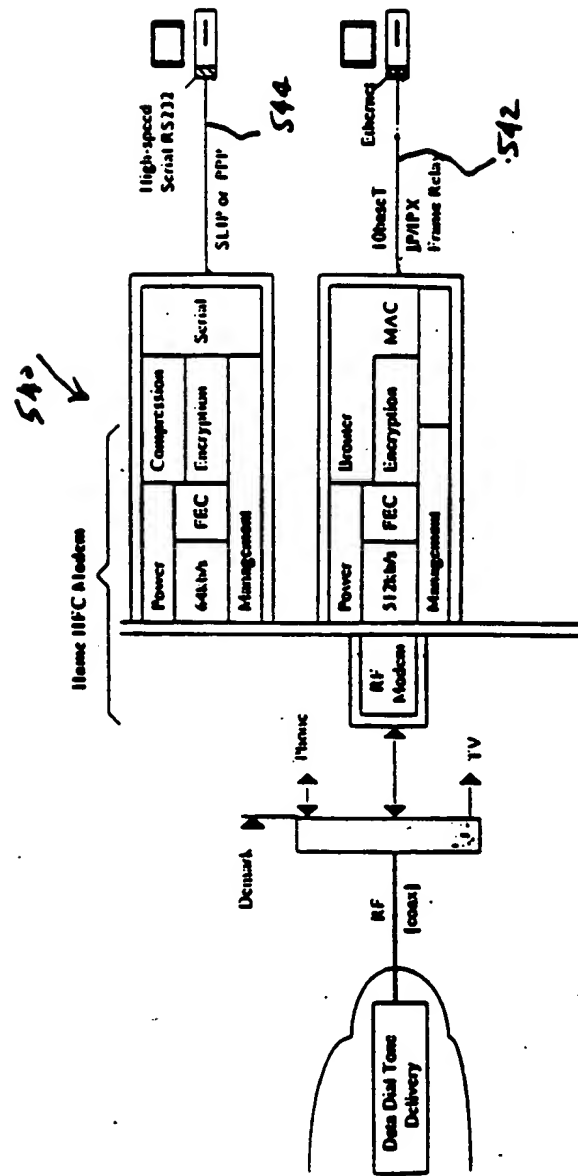


Figure 99

663760-12E2660

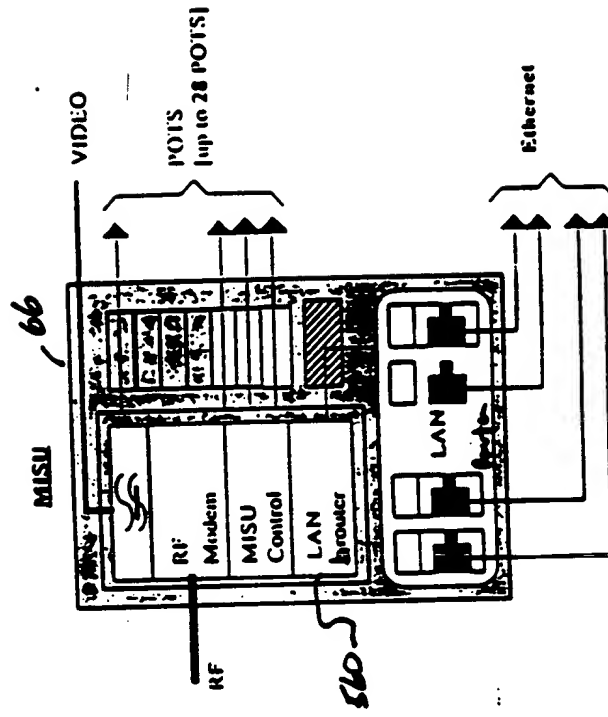


Figure 100

669T60" 4E26E60

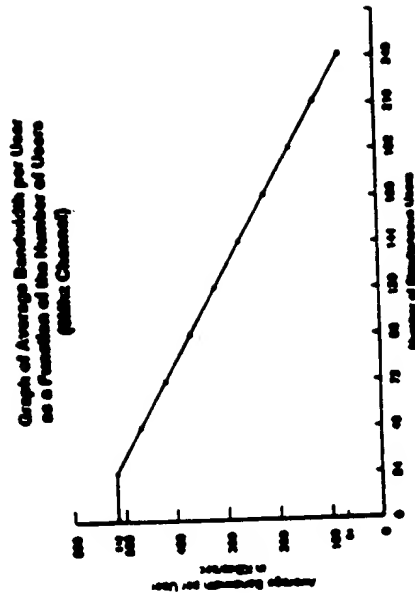
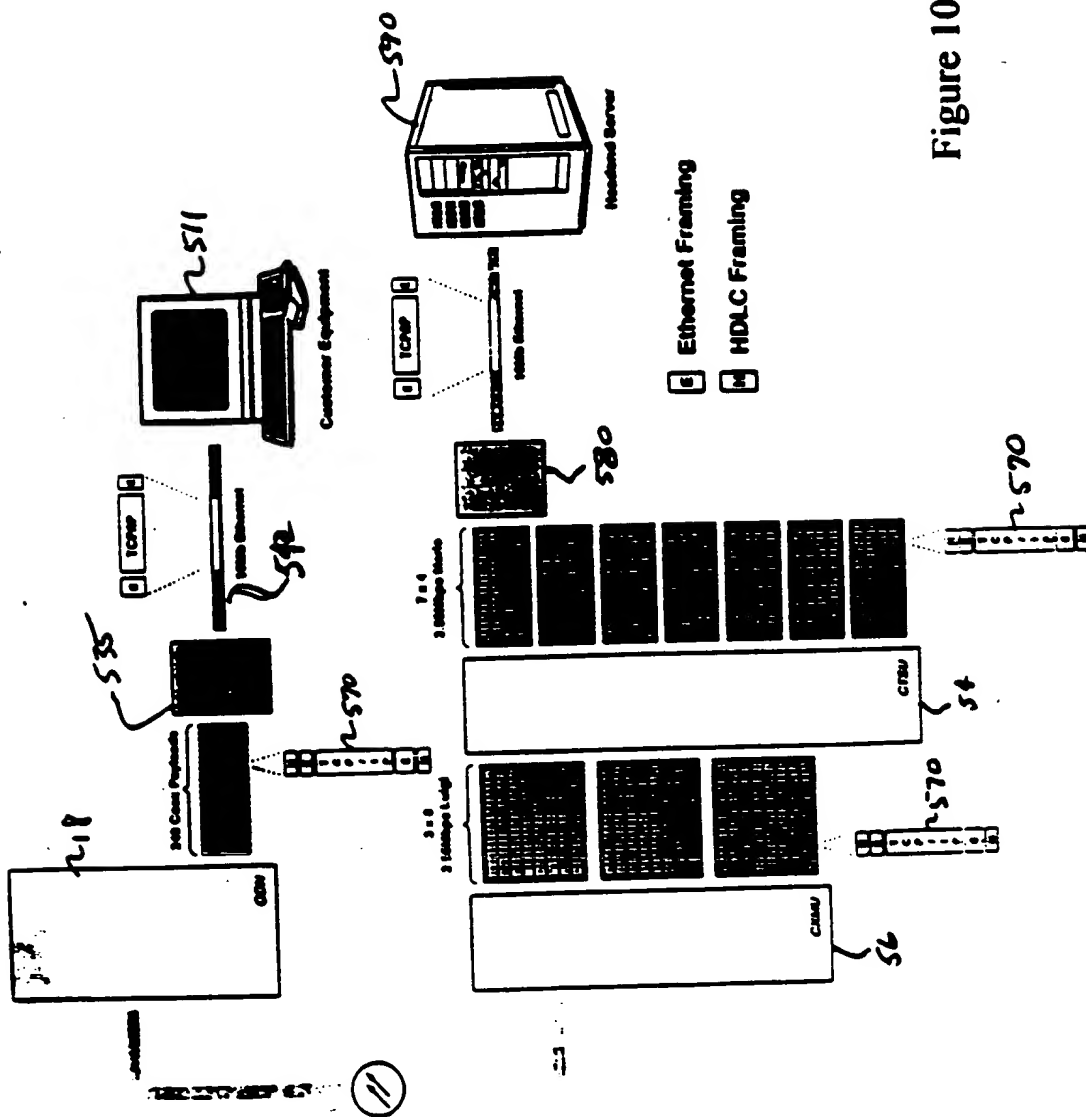


Figure 101

[illegible]

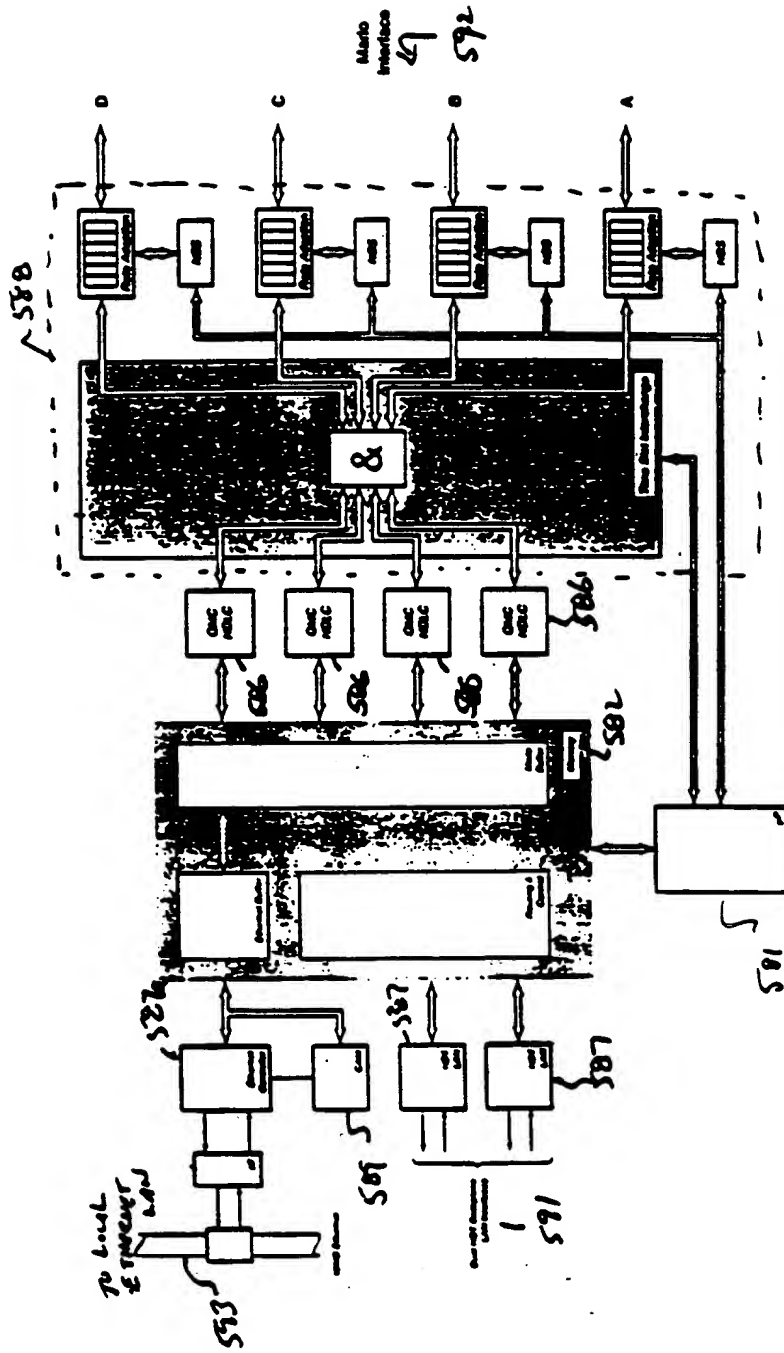


Figure 103

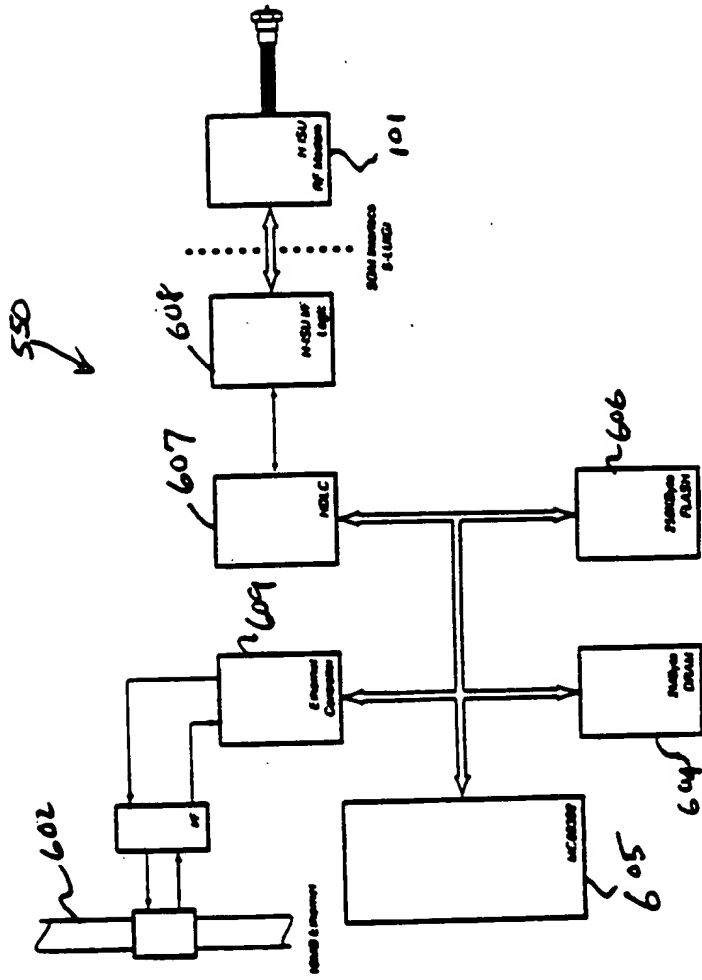


Figure 104

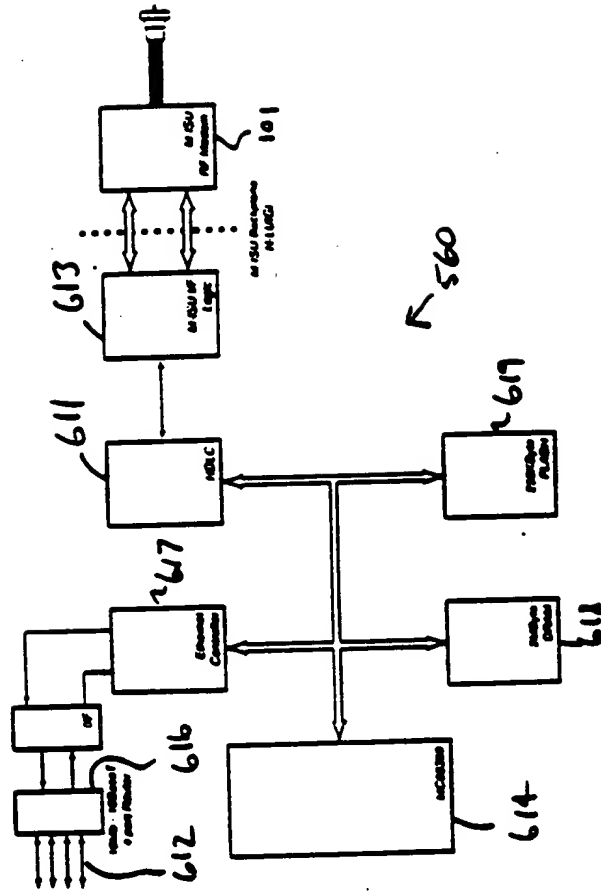


Figure 105

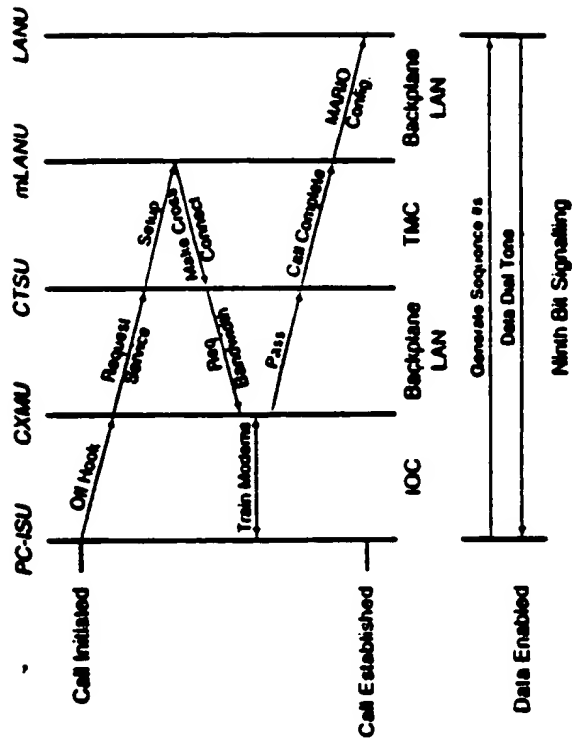


Figure 106

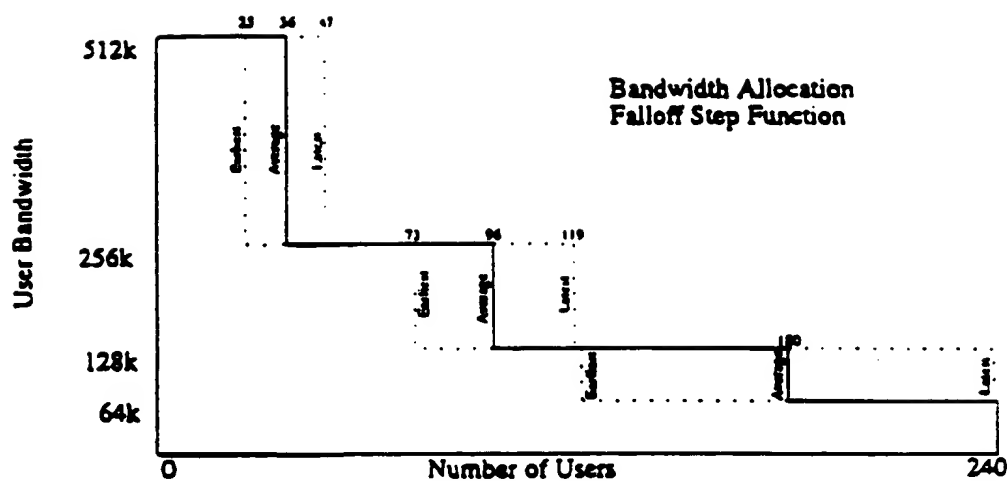


Figure 107

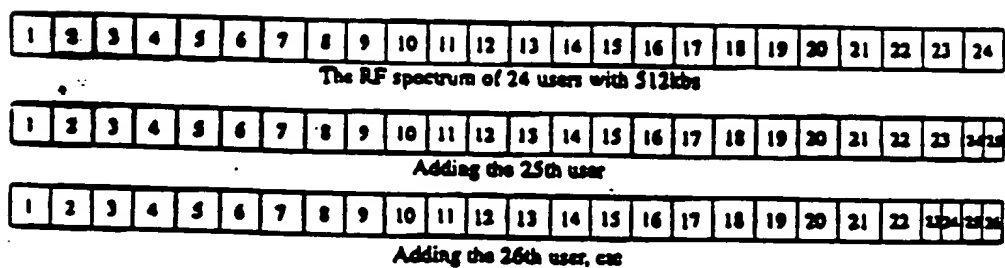


Figure 108

The graph shows the relationship between User density (X-axis, 0 to 240) and User Ratio (Y-axis, 0 to 240). The dotted line represents the User Ratio, which is 1 for user densities up to 64k and then decreases linearly to 0 at 240. The solid line represents the Total Active Users, which is 312k for user densities up to 64k and then decreases linearly to 0 at 240. The graph is divided into three regions: 312k, 256k, and 128k.

User density	User Ratio	Total Active Users
0	1	312k
64k	1	312k
128k	0.5	156k
192k	0	0
240	0	0

Figure 109

603760-1166660

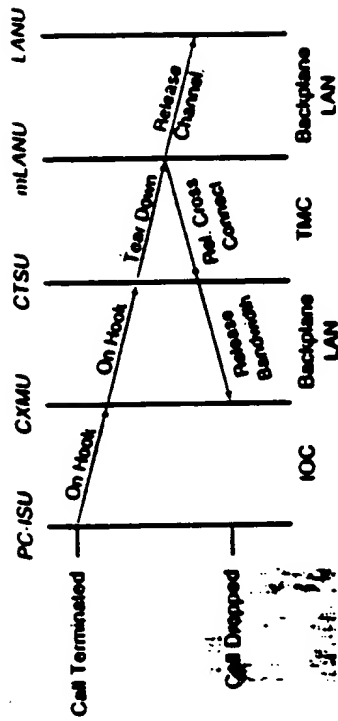


Figure 110

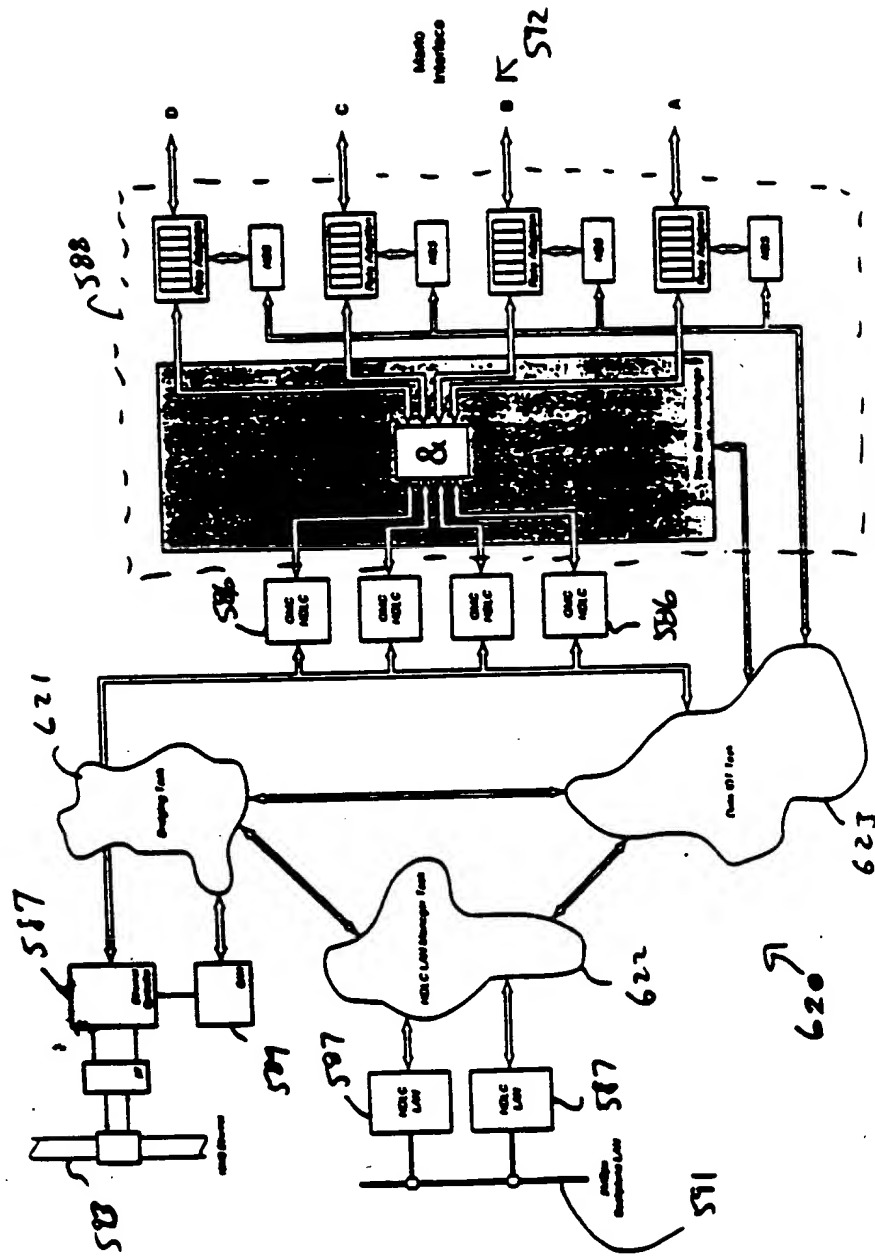


Figure 111

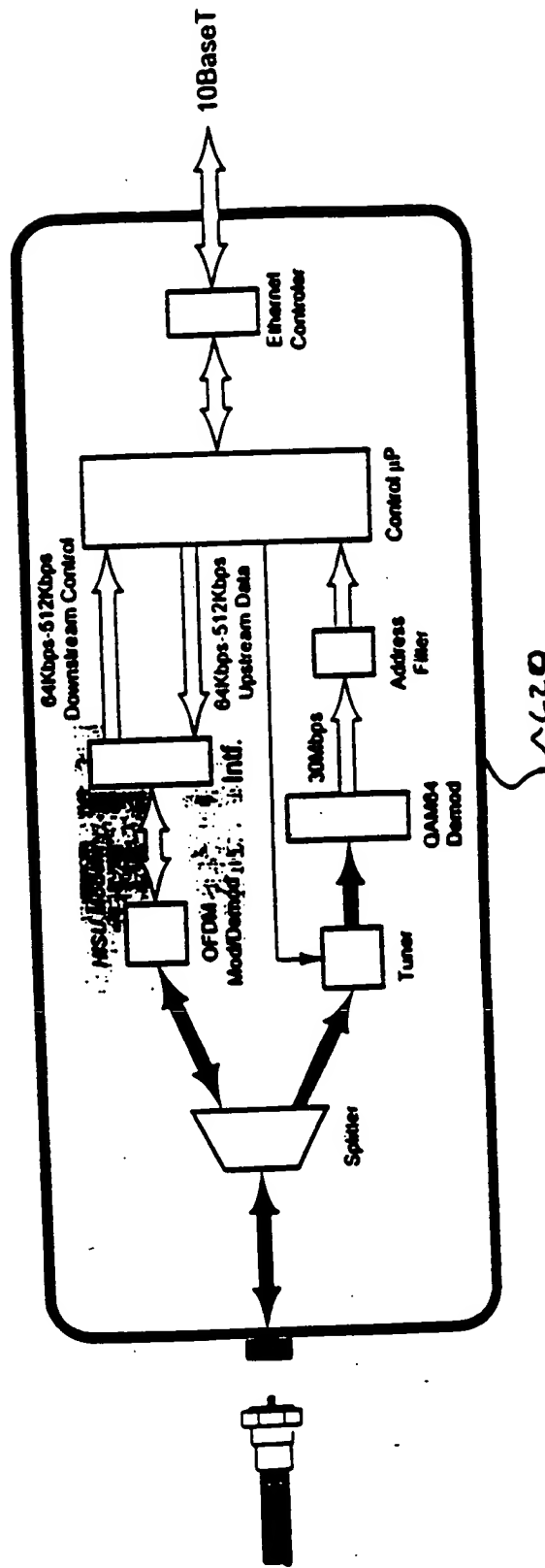


Figure 112

665760" 7666260

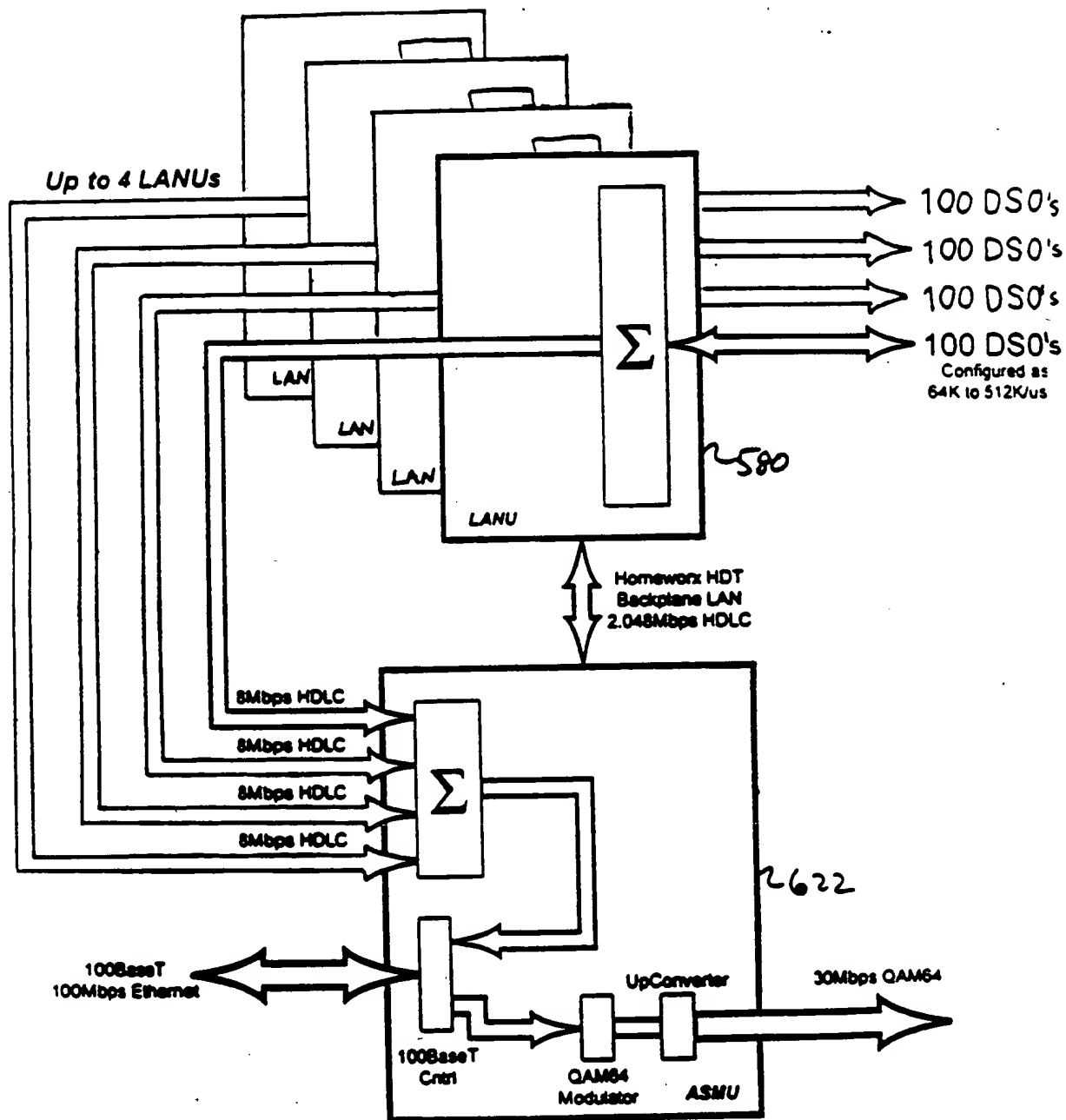


Figure 113

669T60" 11E26260

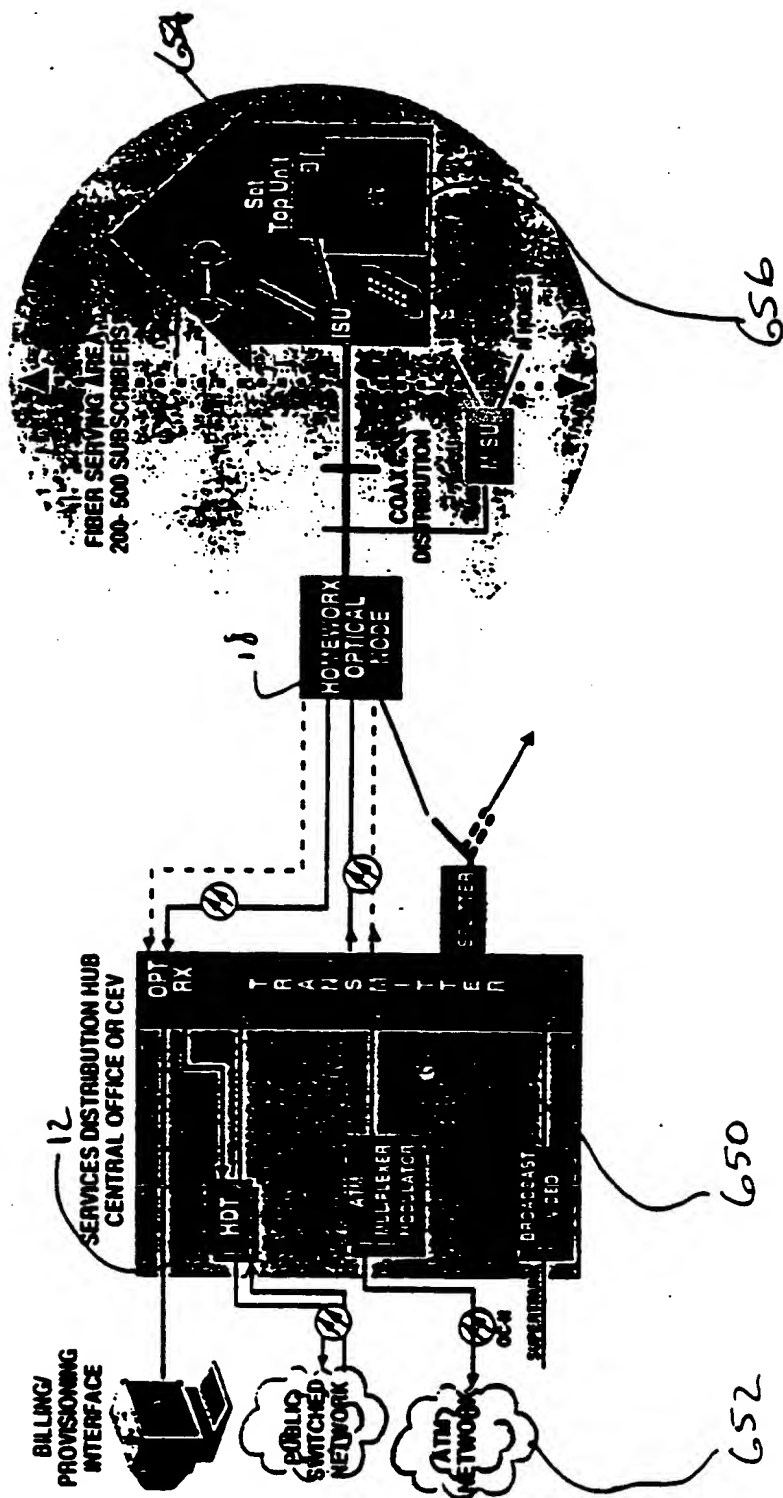


Figure 114

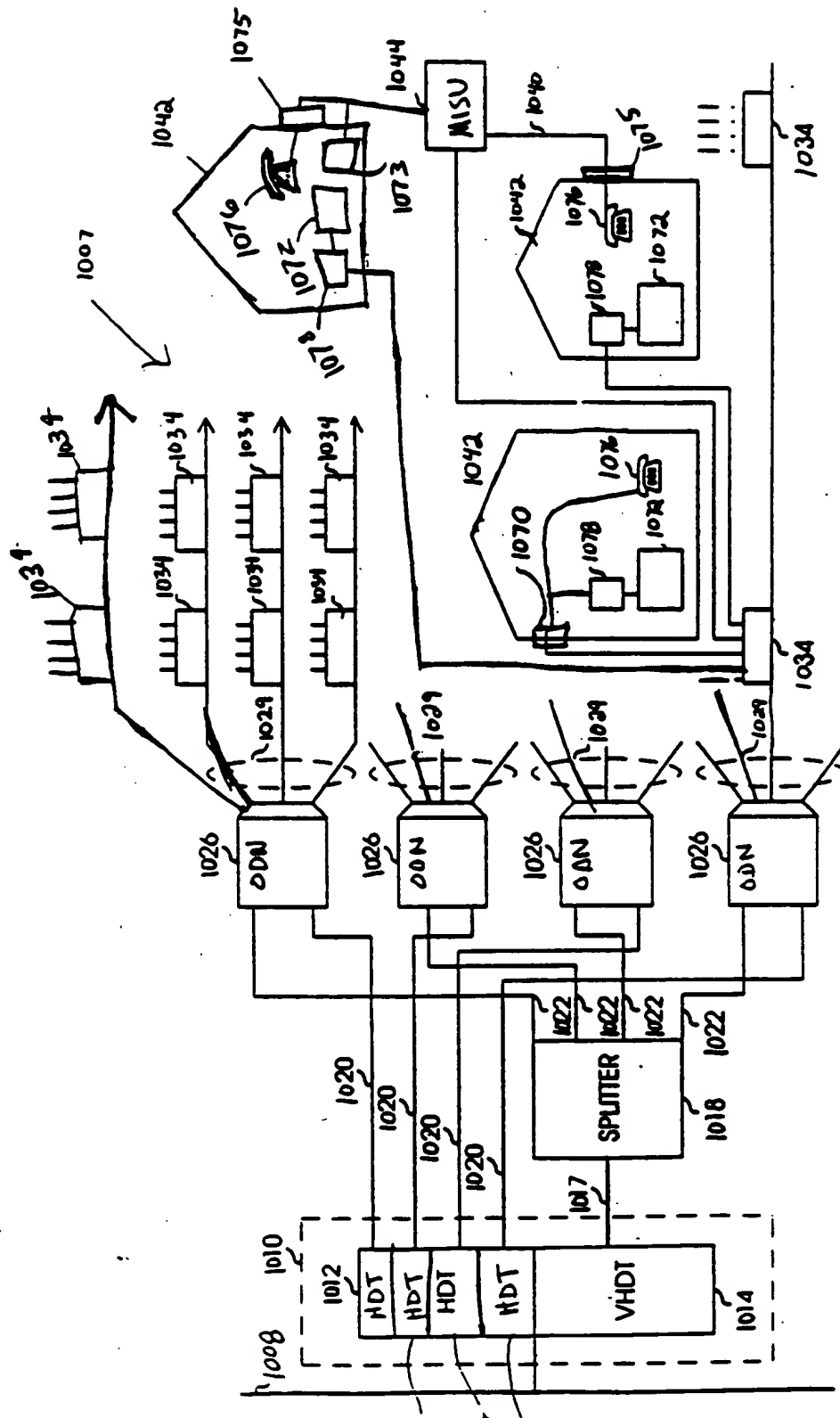


Figure 116

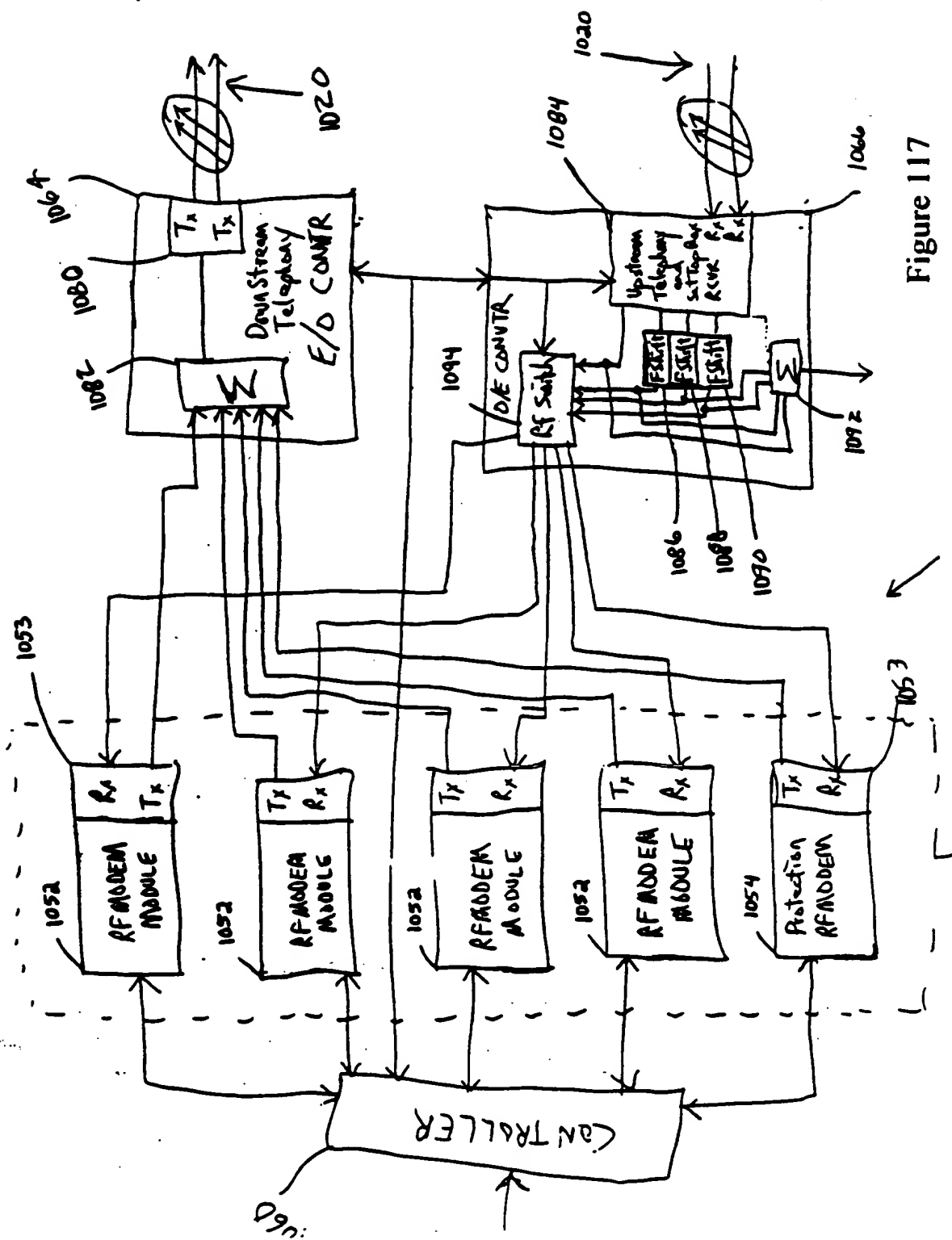
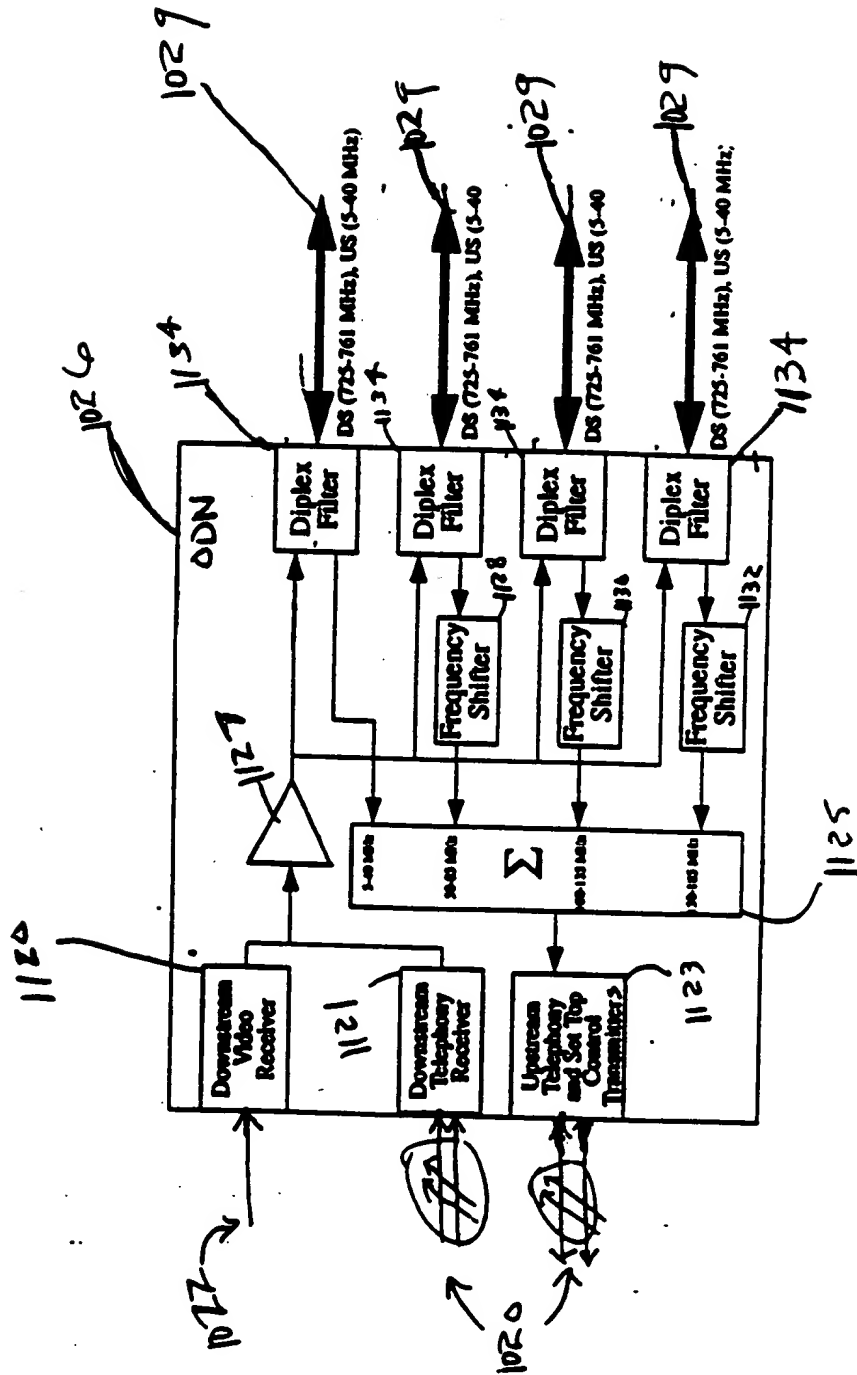


Figure 118



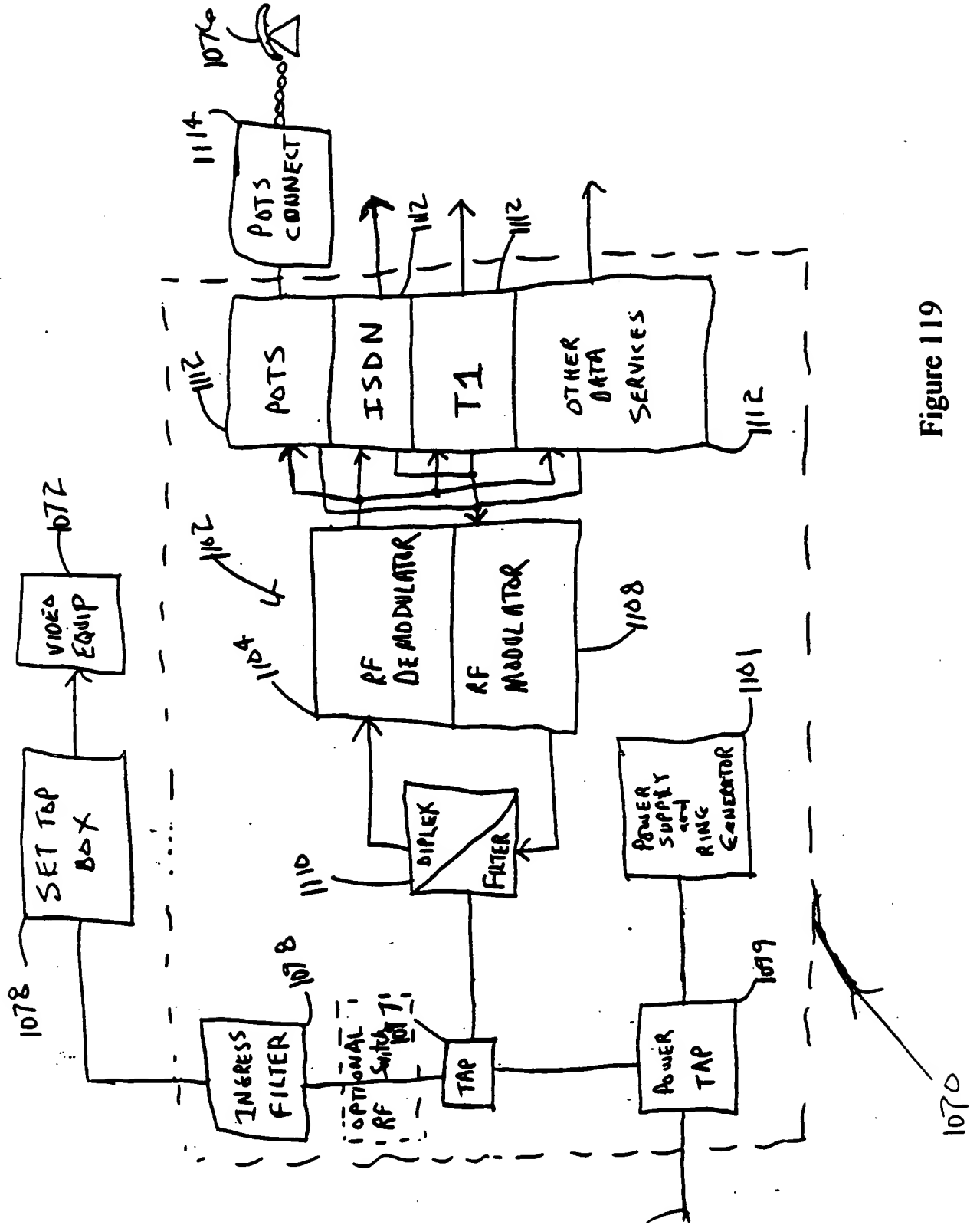


Figure 119

Figure 120

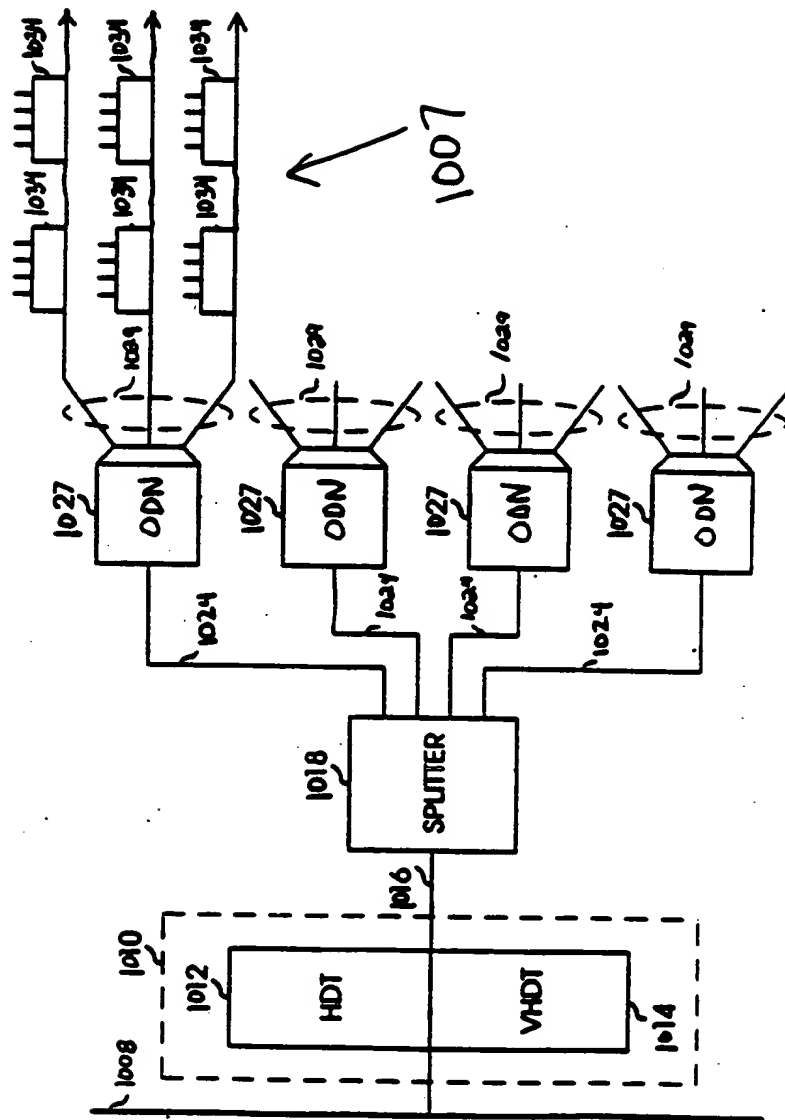
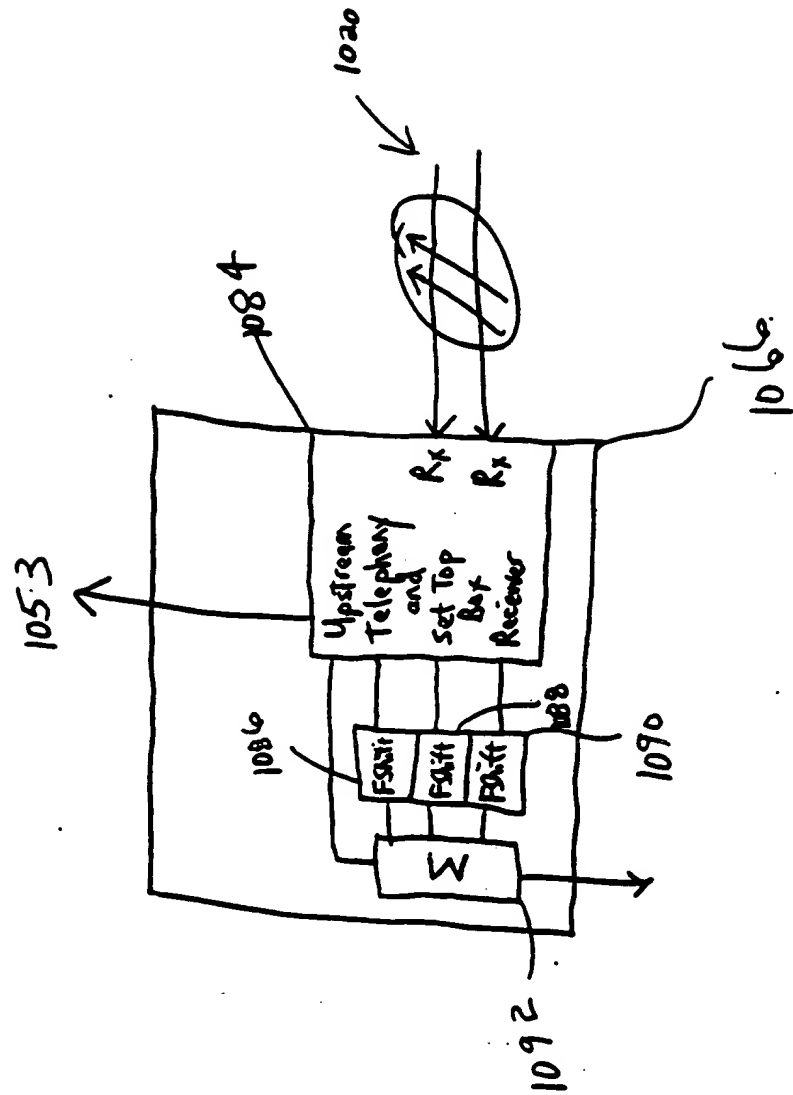


Figure 122



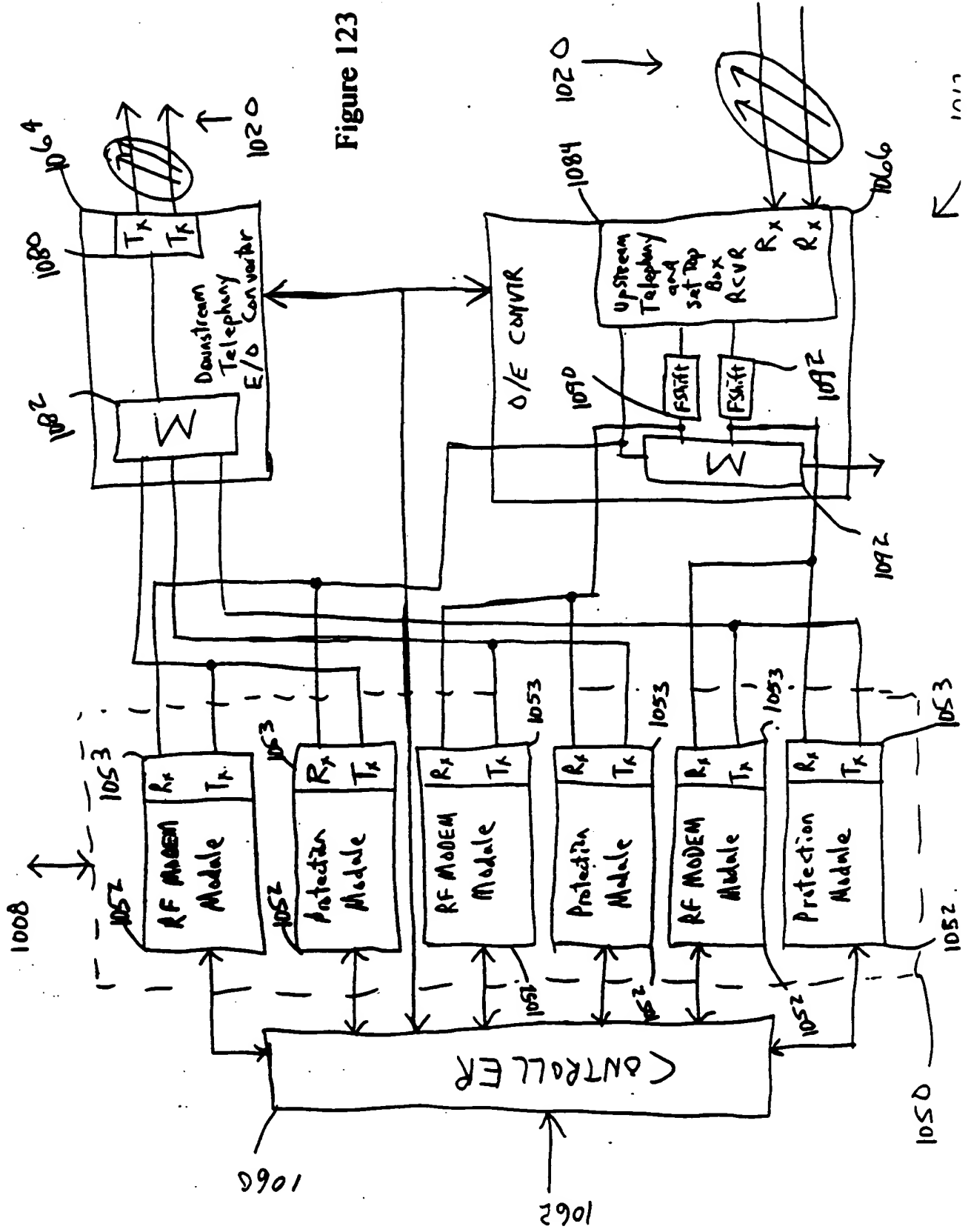


Figure 123

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